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IN THIS ISSUE

MODERN concepts of causation in disease no longer view a disease as the result of a single or specific cause or disease agent. Today, a broader concept is held in which the interplay of multiple factors, involving the host, specific agents and environment, has a determining role in producing disease. This approach to the etiology of disease is reviewed by Dr. H. D. Kruse in "The Interplay of Noxious Agents, Stress, and Deprivation in the Engenderment of Disease." Dr. Kruse shows that infections and toxic agents, stress factors which elicit systemic adaptive reactions, and deficiency diseases do not have separate, independent effects but interact to influence the bodily response. The interrelationships among the many conditions and specific factors which operate to produce disease have special significance for study of the causes of chronic and degenerative diseases which currently are the most important health problems.

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Chronic diseases lead to a great deal of incapacity during middle age, the most productive years of life. The paper "Association of the Chronic Diseases in the Same Person and Their Association With Overweight," by Jean Downes, indicates that certain chronic conditions occur with greater frequency in the same person than would be expected if such conditions were distributed at random in the population.

The chronic conditions found to be significantly associated with overweight are heart disease, hypertensive vascular disease, arthritis, diabetes, and gall-bladder disease. Study of the overweight population indicated that obesity may be the predisposing factor which brings about the significant association of certain conditions in the same person.

Acute respiratory illness is an important cause of disability. The paper "Disability From Respiratory Illness" by Doris Tucher and Jean Downes presents the results of an inquiry to learn whether disabling illness is characteristic of certain people or whether such illness is distributed at random throughout the population.

The population studied consisted of persons in 497 families observed for illness over a period of three successive years. Disabling illness from respiratory disease was found to be characteristic of certain persons, both children and adults, and also such illness was found to be typical of certain families.

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A paper on "Some Demographic Aspects of a Rural Area in Iran" by Mohammad B. Mashayekhi, Pauline A. Mead, and Guy S. Hayes is a by-product of a health survey of 173 villages in an agricultural area of Iran, conducted in 1950 by The Department of Rural Health Development of The Iranian Ministry of Health with the cooperation of The University of Tehran Medical Faculty and The Rockefeller Foundation. The demographic data presented relate to the age, sex, and marital-status characteristics of the population and to various measures of infant mortality, pregnancy wastage, and fertility. Despite its acknowledged limitations this study is of value in illuminating the health and demographic conditions in an area of The Middle East where official vital statistics are woefully deficient.

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The fear of pregnancy and childbirth is sometimes mentioned as one of the deterrents to fertility among modern urban women. Some data bearing on this question were collected in the Indianapolis Study and the analysis of these materials is presented in the article "Fear of Pregnancy and Childbirth in Relation to Fertility-Planning Status and Fertility," by Nathalie Schacter and Clyde V. Kiser. This is the nineteenth of a series of reports appearing in the *Quarterly* under the general title "Social and Psychological Factors Affecting Fertility."

THE INTERPLAY OF NOXIOUS AGENTS, STRESS, AND DEPRIVATION IN THE ENGENDERMENT OF DISEASE[1]

H. D. KRUSE, M.D.[2]

BEFORE focusing on the interrelationship of noxious agents, stress, and deprivation in the production of disease, it is interesting to note that concepts depicting each of them as an independent and sufficient cause of disease appeared at about the same time, the latter half of the nineteenth century. To be sure, noxious agents in the form of toxic substances, poisons, and vapors had been held to be responsible for disease long before this period, indeed back to antiquity. But recognition of bacteria in the origin of disease and what was to be their overshadowing and dominant position among the noxious agents, did not occur until the later era.

Despite their concurrent appearance, the concepts of noxious agents, stress, and deprivation in the etiology of disease emerge separately and unrelatedly. For one thing, noxious agents, especially infectious forms, and deprivation lead to different types of disease. Then too, each of the three pathogenic types was conceived to be sufficient as a sole cause. For example, Bacillus anthracis seemed adequate to produce anthrax; hence, there was no need to search for additional factors. Also, the very design of experimental studies on disease including application of newly developed technical methods tended to narrow the views on causation of a disease and to preclude a less simple concept that embraced multiple parts and their relationship. Finally, infection and deprivation, as producers of disease did not "catch on" and gain followers with equal attraction. The great epidemics, plagues, and pestilences rushing rapidly to a fatal termination were such dreadful menaces

[1] Read before the Eastern States Health Education Conference on Deprivation and Stress in Relation to Health and Disease, The New York Academy of Medicine, New York, April 24 and 25, 1952.

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and scourges with a titanic toll of lives that they transcended all others as the most pressing problem of disease. Coupled with this fearful state of affairs were the rapid developments in bacteriology with microorganisms being isolated in pure cultures and fulfilling Koch's postulates as causes of these infectious diseases. These circumstances imparted to the germ theory not only independence and sufficiency but also dominance. As for stress, it was considered less for the diseases and injuries that it might produce than for the remarkable defense against it with which the body was provided. So in the views on the genesis of disease, noxious agents, stress, and deprivation appeared separately and with little or no connection between them. That was the main current of thought; today it is still the most prevalent. But there have been and are some students who believe that the formulation is not that simple.

To pick up the trail of this point of view, I shall delve into the archives of the remote as well as immediate past in quest of any pronouncement or indication of an appreciation of linkage between noxious agents, stress, and deprivation in the development of disease. Not a few minds have touched upon one or another member of the triad. But I shall restrict my consideration to the more or less full-blown concepts. Because each of them was built primarily around or emphasized one of the etiological principles, it is necessary to examine them in sufficient detail to determine whether other members of the triad have been associated with them. In this search for cognizance of relationships, I have only the written record to guide me in my interpretation. Viewed from the vantage of the present with its presumably more advanced state of knowledge, it is tempting to read into them a recognition of relationships which appear to be implicit though never openly expressed; or to seize upon and magnify a point which the author summarily dismissed with only a passing reference. Inadvertently the legal principle of *nunc pro tunc* tends to creep in to impart a meaning that may never have been intended. In construing

any writings, so much depends upon the bent of the interpreter.

Interestingly enough, it matters not whether we start with noxious agents, stress, or deprivation in their association in etiology, the others are ultimately met. But historically, noxious agents as sources of disease have a claim on priority. By noxious agents are meant agents or forces that are harmful, poisonous, deleterious or inimical to health, and are productive of disease and injury. Included among them in antiquity were toxic substances, poisons, morbific exhalations, and vapors. Likewise, the belief that something more entered into the pathogenesis of disease had equally early beginnings. In Hippocrates' writings on epidemic diseases (1) may be found a keen understanding of man's relationship to his universe; and the effect of environmental influences upon his health and his susceptibility to disease. In the opinion of this profound thinker, epidemic diseases were the product of inimical forces arising out of an imbalance in man's environment. His usage of the term *katastasis,* usually translated as constitution, connoted environmental factors of a meteorological nature contributing to the production of epidemic diseases.

Some 500 years later Galen (2, 3) brought forth a broad yet more particularized formulation which visualized epidemic pathogenesis as a threefold action: atmospheric katastasis, an internal factor, and a predisposing element. With one modification this view has a modern ring. Only the first item, atmospheric katastasis, connoting the miasmal doctrine of epidemic disease is obsolete; at the time of its writing, pathogenic microorganisms were yet to be recognized. Today, it would be called the specific component. Similarly in current concept and language, the internal factor would be the natural susceptibility of the group. And the predisposing element would include the category of environmental conditions enmeshed with the *modus vivendi.* After a long period of neglect this conception reappeared and in its modern version may be recognized in current thought.

During the seventeenth century a non-partisan to the

Galenical doctrine, Thomas Sydenham, who is so well remembered for directing thought to the natural history of disease, revived and added to the Hippocratic tradition. In essence Sydenham magnified katastasis and ascribed to it a significance beyond its originally imputed meteorological influence (3). The term epidemic constitution is of his coinage. But his views on epidemics are expressed with a certain abstruseness which is augmented linguistically by their rendition in Latin; hence, there is difference of opinion over what some of his statements mean. From these ambiguous and obscure writings Major Greenwood (4) has given his modernized interpretation of Sydenham's thesis: "The complete morbid process of an epidemic disease is made up of two parts; the first is specific. . . . The second part is generic, common to all species of epidemic diseases and a function of some terrestrial conditions included under the term 'epidemic constitution.'" Sydenham believed that these mysterious conditions brought about an occult alteration of the atmosphere. The epidemic constitution was regarded to be an essential, but not the sole factor in the pathogenic process.

Two centuries later came the germ theory of disease. Although its advent was foreshadowed (5, 6), its demonstration and establishment may be placed in the time of Pasteur and Koch. With its newly developed technic for studying disease, bacteriology not only attained the status of a separate science but also dominated the theory and practice of epidemiology. Epidemics were conceived solely in terms of causal organisms. The prevailing view became, as Major Greenwood (3) in a rather acid and ironic context puts it: ". . . when the means of infection and the vehicles of infection have been identified, the problem of an outbreak of herd sickness is solved." That principle was for most the final and complete word.

But for some epidemiologists of this century this doctrine had not settled all the problems. Indeed, the influenza pandemic of 1918 aroused one of the skeptics (7) to assert that despite the bacteriological triumphs and reign, two age-old

questions remained unanswered: the periodic recurrence of a disease in epidemic form and the relation between these recurrences and "what used to be called telluric and cosmic influences." Consideration of these topics necessarily led to reflection on the epidemic constitution. The British school of epidemiologists who thought in this vein appreciated the significance of the epidemic constitution while groping for enlightenment on its precise nature. Some identified it as telluric and cosmic influences which to them meant in more concrete terms, climatological and terrestrial factors. But they sensed that these were only a part, that something unknown to them remained.

In writing in 1919 Goodall (8) well characterizes the position when he asks: "How far have we advanced in our conceptions of the causation of epidemics since Sydenham's day? Not very far, I fear, as regards what he calls the epidemic constitution. I am of the opinion that we must still admit that there is a very important factor, or there are very important factors, still unknown, in the causation of epidemics. My conception of the causation of epidemics is that there are several causes at work, varying in number and importance for different epidemics and at different times; that an epidemic is the sum of several factors. Of recent years factors unknown to Sydenham have been brought to light. We know more about the influence of the ages of the persons exposed to attack, of their surroundings, of the seasons, of the part played by insects and animals, and so forth. We also have added to our stock of knowledge the whole of the bacteriological evidence. . . . Admitting a microorganism as a factor, and a very important factor, in the causation of disease, we still are driven in most instances to explaining the causation of the epidemicity of the microorganism; and in most instances, if not in all, we are very far from having attained that object. Sydenham recognized a few obvious causes of epidemics and epidemic diseases, more especially of the latter. But he was also well aware that other causes, which he believed to be the most important,

were still unknown to him, and especially those connected with the more important epidemics. To speak more correctly, all we have done has been to reduce the amount of the contents of this large magazine of unknown factors by withdrawing from it certain factors which we have been able to name, and transferring them to the store of known factors."

On a more optimistic note, Major Greenwood (4) in his rationalization of Sydenham's doctrine of generic or epidemic constitutional factors said: "But it no longer seems that we should regard the basis of an epidemic constitution as beyond the compass of human intellect." In considering intrinsic and extrinsic factors, he acknowledged that variations of natural resistance and environmental conditions, such as diet, do greatly influence the severity of some epidemic diseases (3). But upon reviewing the then available evidence from animals, he regarded it as overly optimistic to accept as experimentally proved "that the amount and severity of infection can be *controlled* by varying diet and race." Appraised by such a pragmatic criterion, he concluded, neither is of primary importance.

Rather, among the factors conducing to continuation of an epidemic, he assigned a potent influence to admission of nonimmunes to a herd in which infection was already prevalent. Recognizing both the immunization resulting from chance sublethal infection and the innate power of resistance with its individual variation, he believed that experimental evidence on their relative effectiveness for survival of animals favored immunization over selection.

During the same period Webster, likewise from studies in experimental epidemiology, reached the opposing view that inborn resistance to infectious disease is a primary factor in determining the fate of an individual during an epidemic (9). Further evidence indicated, according to him, that the level of resistance which is inherited can be altered by environmental factors, not the least of which is diet (10). By sharpening and defining the experimental approach (11, 12, 13) Schneider found an answer to the question (13): "What are the requisites

for a demonstration of the influence of diet on an infection?" In his opinion it is necessary to differentiate genotypes in both host and pathogen; in that way he was able to demarcate the area in which diet has its maximum effect on resistance to infectious disease. It was characterized by genetically heterogeneous hosts being infected by mixed virulent and avirulent strains of pathogenic bacteria, a situation simulating that of man in his natural setting.

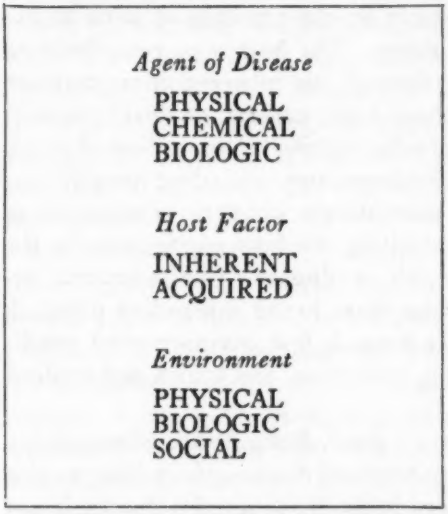

Fig. 1. Schema showing the three elements of the ecologic complex that determine disease, according to Gordon.

One of the present-day exponents of the epidemic constitution, Galdston, has defined (14) its telluric and cosmic influences in more precise and comprehensible terms as "the entire physical environment of the people and in addition, their cultural, industrial and economic status." Moreover, he suggests that the identity of part of the unknown factors of the epidemic constitution is the concept of disease from deficiency or deprivation. Certainly, there is a wealth of evidence to support the view that deficiency states can affect susceptibility to infectious disease (15). In all this Galdston recognizes, of course, that the presence and operation of noxious agents conduce to the production of disease; but he argues that the absence of essential factors, the status of the host, and environmental influences must also be taken into account in any examination of etiology.

Subscribing to this concept of causation, Gordon (16) has placed it in a simple schema (Figure 1). Disease is viewed as

the interaction of the triad: the agent, the host, and the intricate complex of environment. Included under agents of disease are substances of physical, chemical, and biological nature. Disturbance may come about by the presence of some in excess, by a deficiency of others. The host may contribute to the occurence of disease through his inherent characteristics which are of anatomic, physiologic, genetic, or developmental nature. Age, race, sex, and other attributes are indices of them. Also through acquired characteristics, including specific immunity, metabolic and morphologic changes consequent to previous illness, and adaptations, the host participates in the interaction leading to health or disease. Environmental influences may be divided into three broad categories: physical, biological, and social. To name a few environmental conditions: food supply, housing, sanitation, and health and medical services.

These three components—agent, host, and environment—are regarded as the determinants of disease. According to this tenet, the problem of ascertaining the cause of a disease is not solved by identifying the agent. The complete solution comes only after also examining the qualities of the host and environmental influences. This viewpoint is one example of what is sometimes called the doctrine of multiple causation.

In tracing the evolution of thought on the causation of disease, especially infectious disease on an epidemic scale, with noxious agents as the starting point, it may be noted that for completeness in accommodating all the facts, stress and deprivation were brought in as factors. In the latest form of the thesis, as manifested in the views of Galdston and Gordon, many of the influences exerted within the host and by external environment may be recognized as falling in the category of conditions creating stress, although they were not so designated specifically. In addition to noxious agents with their connotation of a positive mode, deprivation with its minus aspect is also incorporated into the formulations. Indeed, Galdston, Webster, and Schneider conceive of both in joint

operation in the production of epidemic infections. In effect, then, stress and deprivation are placed in association with noxious agents as conducive to occurrence of such diseases.

If the production of disease be next examined in association with stress, it is found that Claude Bernard, the eminent physiologist, laid the foundations for this approach (17). Actually, he was thinking in terms of the body's wonderful panoply of protection against the vicissitudes of the external environment, therefore not the engenderment but rather the prevention of disease.

He pointed out that "in animals with complex organization the living parts exist in fluids bathing them, such as blood and lymph, which constitute the internal environment." This environment is fabricated and controlled by the organism itself. As organisms become more independent, more free from changes in the outer world, they do so Bernard said, by preserving uniform their own inner world in spite of shifts of outer circumstances. He wrote: "All the vital mechanisms, however varied they may be, have only one object, that of preserving constant the conditions of life in the internal environment." It was his profound conclusion that: "It is the fixity of the internal environment which is the condition of free and independent life." For, he explained, it is this fixity "which enables an organism to cope with a new or changing environment." According to him, the conditions which must be maintained constant in the fluid matrix of the body in order to favor freedom from external limitations are water, oxygen, temperature, and nutriment (including salts, fat, and sugar).

This concept was further elaborated in scope and detail in 1926 by Cannon (18, 19, 20). To the internal environment, that arrangement in the organization of the body by which all living tissue has intimate contact with fluid, he gave the name fluid matrix. Like Bernard, he regarded its stability as its outstanding feature. The body, being in constant relationship with its surroundings, may undergo internal disturbances from environmental changes. "But," he said, "ordinarily such

HOMEOSTATIC CONDITIONS

A. Material supplies for cellular needs.
   1. Material serving for the exhibition of energy, and for growth and repair—glucose, protein, fat.
   2. Water.
   3. Sodium chloride and other inorganic constituents except calcium.
   4. Calcium.
   5. Oxygen.
   6. Internal secretions having general and continuous effects.

B. Environmental factors affecting cellular activity.
   1. Osmotic pressure.
   2. Temperature.
   3. Hydrogen-ion concentration.

Fig. 2. Cannon's classification of homeostatic conditions.

disturbances are kept within narrow limits because automatic adjustments within the system are brought into action, and thereby wide oscillations are prevented and the internal conditions are held fairly constant." To this steady state of the fluid matrix, Cannon gave the name homeostasis. It is equivalent to Bernard's designation, fixity. However, it should be emphasized that it is not a static state but variation within limits. This homeostatic regulation is exercised over both bodily supplies and processes. Extending Bernard's list, Cannon (18) gave a classification of supplies and processes which exhibit homeostasis but cautioned that undoubtedly it was incomplete (Figure 2).

Homeostasis, according to Cannon, arises from coordinated physiological reactions which through their regulatory action maintain the internal environment in a steady state. The sympatho-adrenal system is the coordinating agency and principal regulator of the internal environment and preserver of homeostasis; the effector organs by which it performs its functions are the second component in the protective system. The signal for bringing this corrective system into action is some change in the internal environment. But it is the role of the protective system to resist such an alteration and preserve the fluid matrix in a stable state.

To the external and internal conditions placing stress upon the regulators of homeostasis and tending to disturb the steady state of the fluid matrix, Cannon gave the name stresses (20). Among them he included: cold, oxygen deficiency, loss of blood, and low blood sugar.

One example from Cannon will set forth his principle concretely. Oxygen is needed to burn non-volatile acid constantly produced by cells. Exposure to high altitude with its lessened oxygen supply brings about a sequence of regulatory and protective reactions: an increase in the heart rate and constriction of blood vessels in strategic areas raise the arterial pressure which in turns hastens the blood flow and thereby accelerates the delivery of oxygen. Contraction of the spleen, the third reaction, mobilizes corpuscles from reserve into active service as carriers of oxygen.

So long as living parts and body fluids are protected from extreme change and maintained in a steady state, the body is spared the peril of serious consequences from these stresses. Cannon emphasizes how extensive is the damage when constancy fails. The effect of homeostasis is, then, to confer freedom from disease, injury, or death arising from stress.

But, as Cannon explains, homeostasis as a state is not absolute and immutable; it may be overcome or weaken and fail. For one thing, there are limits to the ability of the regulatory system to withstand stress and preserve a steady state in the fluid matrix. If stress is increased in intensity or duration, a point is reached beyond which the regulatory system is under too great a strain and is overwhelmed, even though it is performing to its fullest its function of resisting change in the fluid matrix. Then the state of the internal environment is significantly, if not seriously altered. An excessive stress may even induce a breaking strain in the homeostatic regulators. To return to the previous example: if the supply of oxygen fails, acidosis with coma supervenes and even death may occur.

Quite apart from the magnitude of the stress, the functional capacity of the regulatory system may vary over the life span

under influences, both normal and pathogenic, that are accounted to be ordinary vicissitudes and exigencies. Among the conditions that affect the regulatory processes which determine homeostasis are: infection, inactivity, worry, dissipation, loss of sleep.

Finally, homeostasis fails to operate and injurious consequences ensue when the body is entirely deprived of its regulatory system. When the sympatho-adrenal system is removed, a stress that had previously been successfully met now produces a breaking strain.

In this concept which in its entirety goes under the name of physiological homeostasis, the emphasis is on protection from harm through stability of the body's internal environment which is achieved by highly effective regulatory reactions. Nevertheless, although not underscored, noxious states, stress, and deprivation appear in the scheme; and therefore *ipso facto* come into association with serious implications for production of disease. Infections from pathogenic microorganisms as noxious agents are visualized as diminishing the reactive capacity of the homeostatic regulatory system. Stresses are specifically mentioned. Those conditions which elicit the initial change in the internal environment and thereby set off the sequence of protective reactions through the homeostatic regulators are designated as stresses. If sufficiently potent, these stresses may have highly pathogenic, if not fatal consequences. Deprivation or deficit appears in two parts of the concept. Some of the stresses are pictured as arising from deficiency of essential substances; e.g., lack of oxygen and loss of blood. They are adverse and potentially productive of injury. Again, the deficient performance of the homeostatic regulatory processes or actual deprivation of its principal member, the sympatho-adrenal coordinator, has decidedly pathological consequences. Despite the orientation of the concept of homeostasis towards protection of health and life, it is not difficult to discern in it the lines of association between noxious agents, stress and deprivation in the engenderment of disease.

Further developments in the concept of the body's reaction to stress have come from Selye in his general adaptation syndrome (21, 22, 23). He pointed out that various noxious agents produce the same systemic changes. The aggregate of nonspecific systemic reactions which occur upon exposure to stress, he named the general adaptation syndrome. Here adaptation, used in its physiological rather than its evolutionary sense, means a modification in the organism from exposure to environmental conditions which makes it react less to them. It will be noted that in this view the general adaptation syndrome resulting from encounter with stress is apart from and in addition to homeostasis with its maintenance of a steady state in the internal environment. As an emergency adjustment to changes in the environment, homeostasis presents many specific defense reactions. In contrast the general adaptation syndrome with its nonspecific manifestations is an adaptive reaction comprising acquisition of defense against future exposure to stress and maintenance of this acquired state of adaptation. The reaction is general, that is systemic, affecting large portions of the body, adaptive and syndromic; hence, its name.

The general adaptation syndrome evolves in three distinct stages: alarm reaction, resistance, and exhaustion. The alarm reaction is the composite of nonspecific systemic phenomena elicited by sudden exposure to stress to which the body is not adapted. The stage of resistance represents the group of nonspecific systemic reactions evoked by prolonged exposure to stimuli to which the organism has acquired adaptation by that experience. The stage of exhaustion presents a complex of general reactions which occur upon over-exposure to stimuli to which adaptation and resistance have been developed but can no longer be maintained.

In this concept stress is regarded as the factor that elicits the general adaptation syndrome. But it also is an effect as well as a cause. Drawing a proper distinction, Selye uses the term alarming stimuli or stressors to denote agents which pro-

ALARMING STIMULI

- Trauma
  - Surgical Interference with Vital Organs
  - Fractures
  - Crushing of Tissue
- Infectious Diseases
- Bacterial Toxins
- Hemorrhage
- Exposure to Cold and Heat
- Obstetric Shock
- Gravity Shock
- Nervous Stimuli
  - Spinal Transection
- Emotional Stimuli
  - Rage, Fear
- Deep Anesthesia
- Temporary Blood Vessel Occlusion
- Reduced Oxygen Tension
- Burns
- Drugs
  - Colchicine
- Hormones
  - Natural and Synthetic Folliculoids (Estrogens)
- Diet
  - Fasting
  - Overfeeding
  - Vitamin Deficiencies
- X-rays or Radium Rays
- Solar Rays

Fig. 3. Selye's listing of alarming stimuli.

duce systemic stress, that is, affect large portions of the body (Figure 3). Under suitable intensity and duration, an alarming stimulus is capable of bringing about all three stages of the general adaptation syndrome.

Because of the circumstances surrounding their origin the manifestations of the general adaptation syndrome are said not to be readily separated and identified. Agents acting as stressors create stress which operating through the general adaptation syndrome produces both damage and defense. Manifestations of passive nonspecific damage are intermingled with those of active defense; these changes of damage and defense—and only these changes—are integral parts of the general adaptation syndrome. But in addition to creating stress with its nonspecific effects of damage and defense, stressors also have their specific actions. "Hence," Selye asserts (23), "the general adaptation syndrome never occurs in its pure form but is always complicated by superimposed specific actions of the stressors." As a consequence in analyzing "a biologic response"—whether it be intoxication or disease—it is difficult to identify individual manifestations as being due, respectively, to damage, defense, or specific action of the pro-

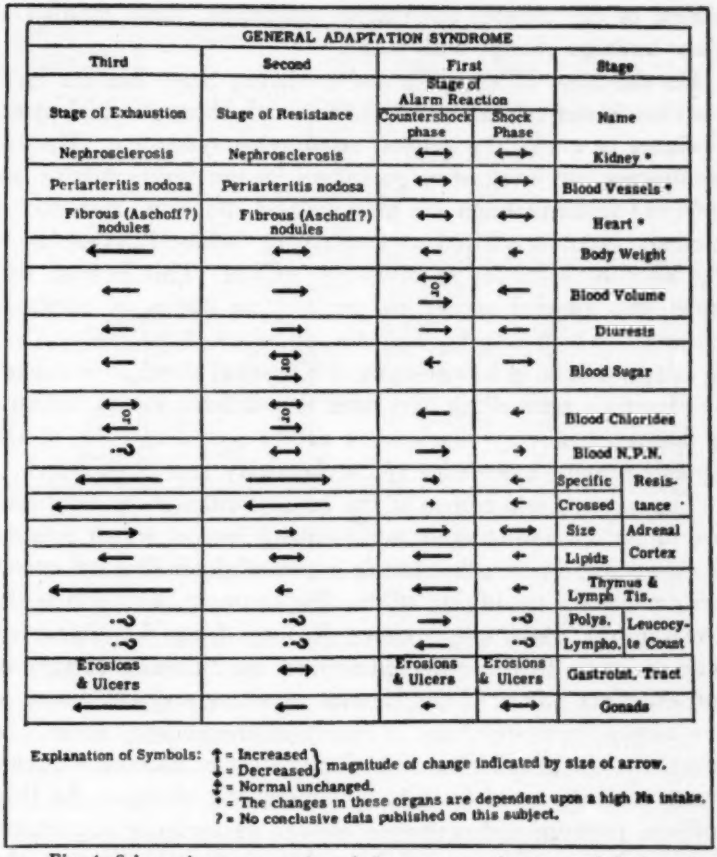

Fig. 4. Schematic representation of the most prominent morphologic and metabolic changes during the general adaptation syndrome and the diseases of adaptation. (After H. Selye: *Journal of Clinical Endocrinology*, 6, 117, 1946.)

vocative agent.

The nonspecific changes which appear during the course of the general adaptation syndrome are of functional, metabolic and morphological nature. A representative list is shown in Figure 4. It should be reiterated that they are nonspecific since they are producible by various agents; furthermore they are systemic or general, that is, not localized or topical. In the

course of the general adaptation syndrome, these manifestations undergo change with stage.

On the basis of experimental evidence, Selye has set forth his view in some detail about the channels through which stress operates to evoke the general adaptation syndrome. The coordinating and integrating pathways for mustering defense are believed to be through the nervous and endocrine systems. A noxious agent is viewed as directly or indirectly stimulating the anterior pituitary to discharge ACTH. This in turn acts upon the adrenal cortex to produce an excess of corticoid hormones which help to raise the resistance of the body. Thus in adaptation as in homeostasis, the adrenal gland is visualized as playing a controlling part with this difference—its function is described in very much more extent and detail out of the greater present knowledge of its chemistry and physiology.

The pattern and course of the general adaptation syndrome are under the influence of conditioning factors which operate in two ways. In one, the specific action of the individual stressors produces a modifying effect. For example, if insulin is the stressor, the blood sugar curve deviates from the characteristic pattern. In the other, peripheral conditioning at various intermediate points of the general adaptation syndrome or in the target organ increases or decreases the activity there. To illustrate, the production and effectiveness of hormones during stress are influenced by diet and metabolic changes. In this, sodium, protein, and carbohydrate are particularly important. In consequence of its modifiability by conditioning factors, the essentially stereotyped defense pattern of the general adaptation syndrome can manifest itself in widely different ways.

From further observations Selye propounded the view that during the general adaptation syndrome some of the anterior pituitary and adreno-cortical hormones are produced in excess. This defensive endocrine response is useful since it raises resistance to stress. But the endogenous hormonal overproduction also has its harmful aspects since it can induce cardiovascular, renal and joint diseases (Figure 5). Thus the

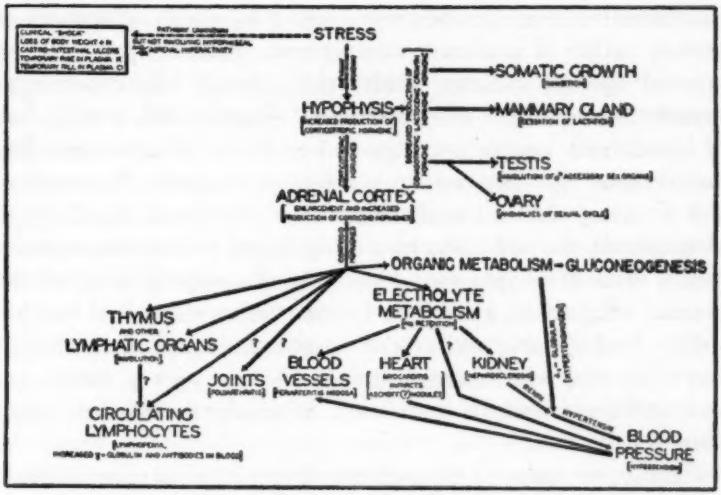

Fig. 5. Functional interrelations during the general adaptation syndrome. (After H. Selye: *Journal of Clinical Endocrinology*, 6, 117, 1946.)

by-products of these excessive or abnormal adaptive reactions to stress are the so-called diseases of adaptation. They include some of the diseases that most frequently afflict man.

Conditions which by their effect on the production and activity of hormones modify the course of the general adaptation syndrome, also influence the production of diseases of adaptation. Indeed, it is postulated that conditions conducive to diseases of adaptation operate by augmenting the production and action of both corticotrophin and corticoids. According to Selye, acceptance that conditioning factors lead to polymorphic symptom complexes in the general adaptation syndrome is basic to understanding the production of diseases of adaptation. Unless conditioning factors could alter considerably the reaction pattern to stress, it would be impossible to ascribe various disorders to the same causative agent, systemic stress.

Even from this barest outline of the general adaptation syndrome and its diseases, a relationship between noxious agents, stress, and deprivation may be visualized. As used by Selye

the term noxious agent is not limited to toxic substances or germs; rather it is almost synonymous with stressor. Stress, created by the stressor, elicits the general adaptation syndrome. As examples of deprivation, vitamin deficiencies, loss of blood, and anoxia are regarded as forms of stressors. But deprivation also appears in a different relation. Removal of the pituitary and adrenals diminishes resistance to all types of stressors; the body becomes ill-equipped to acquire or maintain a state of adaptation. Certainly the responsibility of the general adaptation syndrome for producing disease is emphasized. And its origin is traced to stress. A common, though not reciprocal relationship between noxious agents, stress, excess, and deprivation is recognized, in which excess looms larger than deprivation.

Finally, we come to the concept of deprivation as a producer of disease, which in its original version dates back to the latter half of the last century. Early prospectors among the endocrines and diet unearthed this nugget. At the time when the relation of bacteria to infectious disease was being established and the fixity of the internal environment was being announced, Kocher (24) and Schiff (25) showed that removal of the thyroid led to disease. About twenty years later, Grijns (26) enunciated the doctrine of deficiency diseases arising from lack of an essential nutrient in the diet.

Long after deprivation had been recognized to be a basic mode of etiology, it was regarded as an independent causative, complete and sufficient unto itself and outside the sphere of influences. Indeed, in many minds, such is the position today. Far from relating deprivation and noxious agency in the origin of disease, the prevailing view set the two in contradistinction. It was reasoned that the one leads to disease by a lack, an absence of something, a negative state; the other by a malign presence, the effect of a positive agent. Once again, the design of experiment and technic completely determined the nature of the result, colored the interpretation, and dominated the thinking on etiology of disease. Just as the bacteriological ap-

proach held such complete sway over the interpretation of the causation of infectious diseases that the role of bacteria was magnified to the neglect of associated conditions and etiology was reduced to the overly simple formula, bacterium produces infectious disease; so experimental production of deficiency diseases by inadequate rations so overemphasized diet and disregarded all else that it was regarded as the sole cause of deficiency states. To add to the confusion, for some time the terms diet and nutrition have been used synonymously. This was and is the preponderant way of thinking about the causation of deficiency states, with only a voice or two raised in dissent. Such a view, while wonderfully neat and pat, unfortunately does not accord with the facts. To be sure, this view did regard particular periods, episodes and activities of life as stressful and requiring greater dietary allowances. To that extent stress was recognized, but it was not accorded a place in etiology.

It was already known that factors other than inadequate diet could lead to deficiency disorders. Some students attempted to resolve the complexity, as well as the confusion, of the situation, by retaining the causal thesis of diet in its original form in all its primacy and to dispose of deficiency states from other causes by patchwork amendment, so to speak, that placed them in a separate and subordinate category. Deficiencies arising from an inadequate diet were called primary; those from other causes, secondary. Thus there were two unrelated causations; and the effects, despite their identity, were regarded as two unrelated types.

I have developed a concept of the etiology of deficiency states in which the various aspects previously treated as unrelated and divergent are harmonized and consolidated (27, 28). It contains the three principles of noxious agents, stress, and deprivation, as well as excess, and, what is most important, their interrelationships. It is not relevant to the present topic to retrace the steps, to put together piece by piece the evidence that went into its formulation. Rather on this occasion the

FOR THE BIOLOGICALLY ACTIVE FORM OF A NUTRIENT

$$\frac{\textit{SUPPLY TO TISSUE}}{\textit{TISSUE REQUIREMENT}} = \textit{NUTRITIVE BALANCE}$$

Fig. 6. Ratio determining nutritive balance of a tissue in respect to the biologically active form of a nutrient, according to Kruse.

concept must be presented didactically and then only in skeleton form.

Preparatory to its presentation, a definition of terms is fundamental to clarity. In many minds diet is so closely associated with nutrition that often the terms are used interchangeably with consequent confusion from lack of distinction between them. Nutrition is a bodily process; diet refers to a regimen of food which supports nutrition. This distinction is basic to separating effect from cause; for deficiency states are in reality tissue not dietary deficiencies.

For its nutrition, tissue must have essential nutrients supplied to it to meet requirements for structure and function. Whether nutrition of the tissue proceeds in a favorable or unfavorable direction turns upon the relation between the supply of nutrients to it and its requirements. Tissue nutrition in respect to the biologically active form of a nutrient depends upon this relationship which may be most simply expressed as a ratio (Figure 6).

The ratio takes into account both terms, requirements as well as supply, and their relationship in producing a favorable or unfavorable balance; it summarizes the resultant of this relationship as a causal force for good or poor nutrition. Thus when supply equals or exceeds requirements, the bodily processes operate toward good nutritional status. But when the

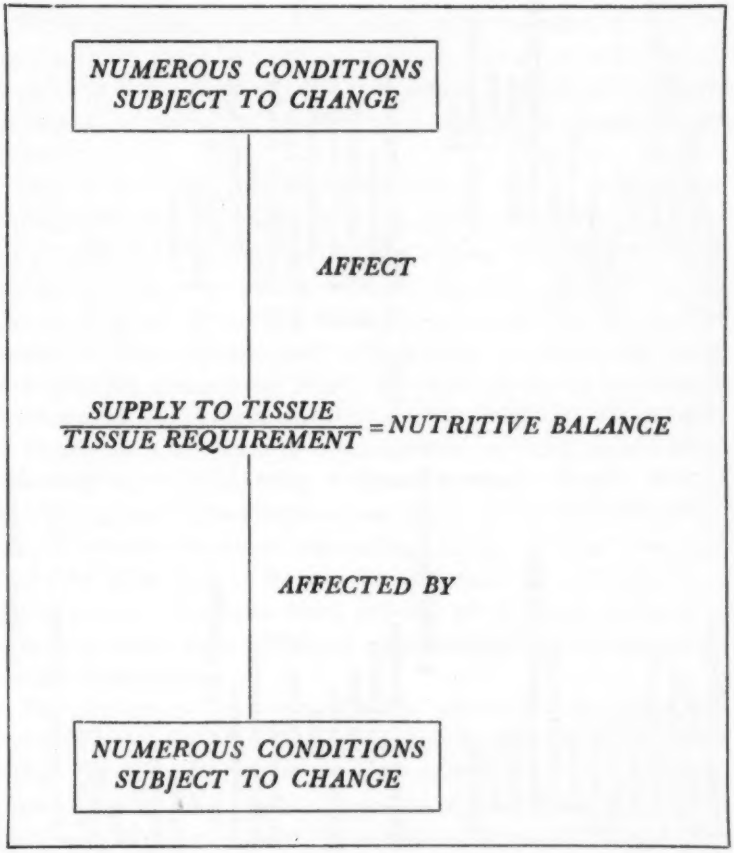

Fig. 7. Schema to show the action of conditions on members of the ratio determining nutritive balance. (After Kruse: Milbank Memorial Fund *Quarterly*, 26, 41, 1948.)

quotient is less than one through need exceeding supply because the former is high or the latter is low or both, it is adverse on an absolute scale. It represents a deficit or deficiency and the bodily processes operate toward poor nutritional status. This deficiency expressed by an unfavorable ratio conduces to the creation, maintenance, or progression of pathological changes in the tissue which constitute a deficiency disease.

CLASSIFICATION OF CONDITIONS

1. *External Environment*

a. *Socio-Economic*
- Living conditions
- Working conditions
- Available foods
- Ability to seek them
- Income
- Education

b. *Physical and Chemical*
- Radiant energy
  - Light infra-red
  - Ultra-violet, x-ray
  - Radioactive
- Temperature
- Mechanical
  - Trauma
  - Physical movement
  - Pressure; irritation; friction
  - Occlusion
  - Dentures
- Toxicants

c. *Time*

d. *Dietary*
1) Form of nutrient
   - Provitamin: analogue
   - Potential or intrinsic biological activity
2) Level
3) Imbalance—
   - Disproportion
4) Interrelations
   - a. Protein-Carbohydrate-Fat
   - b. Vitamin-Vitamin
   - c. Vitamin { Protein / Carbohydrate / Fat }

2. *Bodily Environment*

a. *Digestive and Metabolic Channels*
- Functional form of nutrient
- Appetite
- Ingestion
- Digestion
- Absorption
- Transport
- Formation of enzyme
- Breakdown of enzyme
- Elaboration } Metabolism
- Utilization } Metabolism
- Storage
- Metabolic level
- Excretion
- Biosynthesis
  - Intestinal synthesis
- Biodegradation
  - Intestinal destruction

b. *Functions and Reactions*
- Disease { Degenerative / Neoplastic / Organic / Toxic / Infectious }
- Chemotherapy
- Endocrine relationship
- Nutritional status
  - Morphology and physiology of tissue
- Growth
- Pregnancy
- Lactation
- Work
- Psychobiology
  - Food habits
  - Psychosomatic reactions

c. *Time*

5) Inhibitors—Antagonists
   - Anti-vitamins
6) Enzymatic destruction
7) Autoxidation-rancidity
   - Oxidants-autoxidants
8) Processing of foods
9) Availability of nutrients
   - Precipitation
     - Phytic acid—Iron
     - Oxalic acid—Ca
10) Acceptability—
    - Palatability

3. *Genetic Patterns*

Fig. 8. Classification of conditions affecting the ratio according to their natural location and character. The list is not exhaustive. (After Kruse: Milbank Memorial Fund *Quarterly*, 26, 41, 1948.)

Parenthetically, it should be noted that for some, if not all, nutrients the ratio has an optimum zone above which as well as below which it is adverse. For example, a supply of lipogenic nutrients in excess of requirements would be conducive to obesity.

One of the most significant features of the ratio is its dynamic behavior. It reflects the continuous operation of its terms with the capacity to undergo change at any time. The terms and ratio may change in either direction, decrease or increase. Thus by a decrease in supply or an increase in requirements, or both, a satisfactory ratio may be lowered to the point of indicating a deficiency which sets into operation the bodily processes in an adverse direction. Oppositely, by an increase in supply or a decrease in requirements, or both, a low ratio reflecting an unsatisfactory balance increases thereby setting into operation the bodily processes in the more favorable direction. Certainly the ratio can undergo change at any time, and probably does change frequently or continually, if only to a slight extent. Evidence from persons of all ages indicates a long-term trend over a lifetime with seasonal cycles and intercurrent fluctuation.

But change is not a spontaneous, inherent property of the terms of the ratio. It is brought about by influences upon the terms. These influences affect both terms, i.e., supply and requirements: some act on one; some on the other; some on both. They may change the terms favorably or unfavorably and may likewise change the ratio. These influences are conditions, a precise yet shorter term than conditioning factors (Figure 7). Conditions exert their effects by their presence or absence, and by their excess or deficit.

All the external and internal environmental as well as hereditary factors that influence either or both members of the ratio in whatever direction are conditions. They are manifold (Figure 8). Diet, growth, pregnancy, lactation, work, sunlight, climate, toxic material, and disease are just a few of those included in the list. It is to be noted particularly that conditions

embrace those of a dietary as well as a nondietary character.

Not only are the conditions numerous, but they are multiple in operation. In any instance several or many conditions are affecting the ratio and it is their resultant which determines its balance. Furthermore, these conditions are dynamic in nature. They are capable of change and are constantly exerting their influence on the ratio. According to their nature or circumstances, conditions differ in their schedule of activity or influence. Some are continuous through life, constantly in action. Others, impermanent, may occur frequently, occasionally, or only once; and may last a very short or very long time.

These multiple conditions act upon the ratio by influencing both of its terms; some affecting supply, some altering requirements, some modifying both. Conditions that increase the numerator or decrease the denominator tend toward making the ratio favorable; those that operate oppositely conduce to an adverse ratio. When untoward conditions predominate and the ratio tends to a decline, counteracting conditions operating in a favorable direction are brought into action. It is a homeostatic reaction, an attempt at adjustment. As another means of protection, particularly offending or adverse conditions may be removed, controlled, or diminished. Despite preservative reactions, the adverse conditions may preponderate; then the ratio moves towards, enters or sinks deeper into the pathological zone.

It is the net effect of the aggregate of conditions that determines the quotient. Never is one solely responsible for an adverse ratio. Since not only the cast of conditions but also the degree of activity of any condition may change from time to time, the proportional influence of each adverse condition in the composite may vary. Hence, the etiological complex exhibits relativity.

An adverse ratio and the combination of conditions responsible for it comprising a complex can be regarded as the cause of the resulting deficiency state in the tissue and its ensuing pathology. But in the interest of clarity and precision in delv-

ing into the etiological system, a distinction should be drawn between the ratio and the conditions. The adverse ratio is the primary, direct, immediate cause of the tissue deficiency process; while the combination of conditions influencing the ratio to that end are secondary, indirect, mediate causes. Most simply and accurately designated, the adverse ratio expressing deficiency is the cause; factors responsible for its unfavorable level are adverse conditions. But it should be reiterated that not only the adverse ratio but also the conditions which brought it about are a fundamental and integral consideration in the etiology of deficiency states.

To clarify what is meant by conditions and how they influence the ratio, it might be helpful to cite a few familiar examples of them and their effect on the development or accentuation as well as on the subsidence of deficiency states. A gastrointestinal disorder may impede absorption and transport of nutrients and thereby interfere with supply to the tissues. Decrease in supply diminishing the quotient of the ratio tends to a deficiency state.

Acting on the other member of the ratio, growth, pregnancy, and physical labor are conditions conducing to deficiency states by raising the level of requirements. It is a commonplace in experimental studies with deficient diets that animals must grow if they are to develop acute deficiency states. In pregnancy the incidence of deficiency disease in exacerbated form has been repeatedly observed. And bed rest is a highly effective therapeutic measure for abating deficiency disease. In all three examples, growth, pregnancy, and work, the recognition of increased requirements associated with them is evidenced by larger recommended dietary allowances. The attempt is to increase supply to counterbalance the increased requirements. But to repeat, although each of the three conditions may precipitate an aggravation of deficiency states, it should not be concluded that any of them alone can bring it about. Unless other adverse conditions, such as inferior diet, disease or pre-existing poor nutritional status prevail, growth, preg-

nancy, or physical exertion does not set off deficiency signs. Of the aggregate of adverse conditions contributing to an unfavorable ratio, one is usually decisive in the sense that it adds enough to tip the scale. It is, however, not necessarily the major adverse force; rather its timing attracts disproportionate attention to it.

At the risk of seeming to minimize diet, whereas the intent is to bring the ensemble of conditions into proper perspective in which neglected members are elevated to their rightful place, it should be pointed out that poor diet is not the cause of a deficiency state but a condition conducive to it. Poor diet alone cannot produce a deficiency state; for it is never the sole condition in operation—other conditions intrinsically participate. Deficiency states may even occur when diet is satisfactory and therefore operating favorably on the ratio. True, in many, if not most, instances of deficiency disease, poor diet is the major adverse condition; but in other instances, it is a minor condition. Sometimes deficiency disease occurs when diet is not an adverse condition.

Two of the most influential adverse conditions are infection and existing poor nutritional status. An infectious disease may lower food consumption and interfere with absorption and utilization. As a condition, not a cause, it conduces to pathology of deficiency. Also especially noteworthy among the list of conditions is existing nutritional status. If the tissue is already the site of deficiency pathology, usually chronic, its requirements obviously are raised.

It has been demonstrated that many conditions, among them growth, pregnancy, and disease, affect nutrition. But whether there is a reverse relationship, a reciprocity of nature, in which nutrition influences these functions of life has been a transcendent question. Studies with animals on these relationships have yielded a decisive and convincing affirmation. Evidence on man is naturally less abundant. But certainly reciprocity has been fully established for nutrition and growth. Data from four separate human studies have put the favorable

effect of improving nutrition on pregnancy beyond the questionable stage. And even in the far more complex and difficult matter of ascertaining in man whether nutrition confers any benefit in combatting noxious states, definite results of a positive nature have been obtained. From these lines of evidence the conclusion is inescapable that nutrition and some of its conditions, particularly bodily conditions, are interrelated in a two-way action.

In this concept, all three members—noxious agents, stress, as well as deprivation—are to be found among the conditions. Noxious agents represent one type of conditions which tend to depress the ratio. As for stress, the term may be applied to the action or effect that imposes a burden, adversity, or strain when a force or influence is exerted within or upon the body. In this sense, it is a generic term for a broad class and is an effect as well as a causal component. Conditions, such as deficient diet, growth, and pregnancy, that operate towards lowering the ratio produce stress. In sum and substance, then, stress is the effect of conditions which in turn is exerted upon the tissue ratio. Deprivation not only represents a type of condition, but also appears as an expression of the resultant state of tissue nutrition as manifested by ratio. Deficient diet, for example, is a condition of deprivation; it contributes to nutritional deprivation of the tissue.

Actually all three terms—noxious agents, stress, and deprivation—are generic; that is, they represent types or classes. Besides, as categories they are not mutally exclusive. For example noxious agents and deprivation itself, when it is an inimical condition, are sources of stress. On the other hand, in the interest of completeness, excess which has already been mentioned as having a place in the concept, should be added here as the fourth category. In this light two points emerge out of the concept that are more important than identifying examples of these categories among conditions.

It may be noted that each condition, according to its character, operates pathogenically in one or more of these cate-

gories. Indeed, these categories have been used to connote types of disease-production. But unfortunately some of these categories—stress in particular—are not homogeneous: their members do not have a pathogenic action that is the same in principle. For example, noxious agents, excess, and deprivation can produce stress. It would seem desirable, therefore, to have categories of pathogenicity based on their own common characteristics. Such a system might include the following four classes of pathogenic states: presence, excess, deficit, absence. Accordingly, the first point is that each condition operates by virtue of one of these states. It follows, then, that the status of each condition may be expressed by its own ratio. To differentiate it from the ratio of tissue nutrition it may be called condition ratio. If the condition be of the noxious agent type, a plus indicative of presence or excess has pathological significance. If it be of a type applicable to nutrients and hormones, absence, deficit, or excess has pathological significance. The state as well as the nature of the condition is, therefore, of consequence. There is then a coalition of conditions, some noxious and positive through their presence or excess, others depriving and negative through absence or deficit, each with its adverse ratio, each conducive to disease.

Against this group of conditions with the aggregate of their ratios tending to depress the ratio of tissue nutrition, other conditions by virtue of their presence, excess, deficit, or absence support it. The effect of all conditions with their individual ratios, adverse and favorable, is expressed by the ratio of tissue nutrition. In the event of an adverse change in this ratio, there is a reaction of opposition in which new counter conditions are called into action, existing favorable conditions are intensified and adverse conditions are lessened to bring a more favorable turn to the ratio or hold its adverse shift to a minimum. Viewed as a whole, the concept takes cognizance of an aggregate of adverse, counter, and favorable conditions, each operating by virtue of its presence, excess, deficit, or absence, and each having its individual ratio, whether adverse

or favorable. The resultant of all these ratios is reflected in the ratio of tissue nutrition.

The other significant point in the concept is that noxious agency, stress, and deprivation are interrelated, that presence, excess, deficit, and absence as states of conditions interact in the engenderment of disease. Of course, adverse conditions whatever their mode of pathogenicity are related in so far as they have a common action on the tissue ratio. But more than this, the bodily conditions exhibit interplay. A condition acts upon tissue nutrition with its ratio; in turn there is a reaction upon not only the same but also other conditions. Here are a few examples: Infection creates a tissue deficiency; a tissue deficiency predisposes to infection. With a deficient diet, growth is one of the conditions necessary in order to produce an acute deficiency state in healthy, young animals. On the other hand, deficiency states retard or suspend growth. Pregnancy may be accompanied by deterioration in nutrition; conversely, subnormal nutritional status may impair pregnancy. Between these conditions and nutrition there is an interaction. Furthermore, infection through its effect on nutrition may interfere with growth or pregnancy. The reverse is equally true: growth or pregnancy may exacerbate an infection. It is concludible, therefore, that through the medium of nutrition, one bodily condition is related reciprocally to another in pathogenesis. Indeed, to use the very words of the subject, there may be seen an interplay of noxious agents, stress and deprivation in the engenderment of disease. Since such condition has its own ratio and the resultant of all conditions is expressed by a ratio, there is an interrelationship expressible by ratio. It may be noted that the positive ratio representing presence of infection is one condition contributing to a negative nutrition ratio which in turn reacts to further the positive ratio of infection yet at the same time lessens the ratio of growth.

In this concept originally designed for tissue nutrition, the ratio pertained to any biologically active form of a nutrient and emphasis fell on deprivation as a pathogenic principle. But

as previously mentioned, it also covers excess and presence. Furthermore, the pivotal ratio with its constellation of conditions is equally as applicable to a noxious agent or hormone as to a nutrient. Hence, it is useful in conceptualizing the etiology of noxious states and endocrine disorders. For example, it should be noted that Selye in elaborating on the general adaptation syndrome has emphasized the importance of the $\frac{\text{gluco–corticoid}}{\text{minerals–corticoid}}$ ratio in the pathogenesis of arthritis (29) and hypertension (30). Indeed, the pivotal ratio would appear to be adaptable even to psychiatry, whether in its psychodynamic, psychosomatic, or somatopsychic aspects. For in this category of disease the same battery of pathogenic principles—presence, excess, deficit, and absence—again appears. The association of mental disorder with infection and the experimental production of psychotic states by drugs are well-known examples of the action of noxious agents. Liddell has stated that the incorporation of the concept of stress situations has given new life and meaning to the conditioned reflex which already included an element of deprivation (31). Social stress, economic stress, and various other types of stress are today common terms in psychiatry. And striking indeed are Spitz' observations on the effects of deprivation of maternal affection, a familiar theme in present-day discussion of emotional and behavior problems (32).

I have approached the consideration of etiology of disease by presenting concepts in which noxious agents, stress, and deprivation, respectively, appeared to be the prime factor; but in each instance the other modes were always found to have a part and in some were inextricably interwoven. It is striking how well the various concepts fit together and fill out in broad outlines the expanse of pathogenesis. It was as if we were looking at one map from first one and then another direction. In sweeping across it from whatever direction, ultimately the eye came upon the same familiar markings and connecting pathways—noxious agents, stress, excess, and deprivation.

I have not attempted a comprehensive critique of the various concepts, only an examination of them for their components and relationships. From this examination one point which they have in common stands out: there are multiple factors that operate in the production of disease. Three other points appear with varying degrees of recognition, becoming increasingly prominent in the more recent concepts: (1) among the etiological factors are noxious agents, stress, excess and deprivation; (2) they operate through their presence, excess, deficit or absence; (3) and between them there is an interrelation.

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ASSOCIATION OF THE CHRONIC DISEASES IN THE SAME PERSON AND THEIR ASSOCIATION WITH OVERWEIGHT

JEAN DOWNES[1]

THE problem of chronic disease has become one of the major concerns of public health. Conditions classed as "chronic" lead to a great deal of incapacity during middle age, the most productive years of life. A study of morbidity conducted in the Eastern Health District of Baltimore has revealed that only 14 per cent of the total population was affected by chronic disease. However, one-third of all of the medical calls rendered to the population annually and about one-fourth of the hospital admissions were because of chronic illness. These facts serve to emphasize the gravity of the problem of chronic disease.

A study of the association of the chronic diseases in the same person and their association with overweight in a sample population is of more than academic interest. Data from the morbidity survey made in the Eastern Health District of Baltimore are used for this study and are presented in this report.

DATA AND METHOD OF STUDY

The data presented in this analysis include persons with one or more major chronic conditions reported to be present in a sample of families living in the Eastern Health District of Baltimore during the period June, 1938 to May, 1943. Briefly, the method of study was as follows: Families living in thirty-four city blocks were visited at monthly intervals to obtain a record of illness among their members. In seventeen of the thirty-four city blocks the families were visited over a period of five years; in the other seventeen visiting was continued for only three years in families where no persons with chronic disease were reported during that period.

The instructions for the use of the family visitors contained

[1] From the Milbank Memorial Fund.

a list of the more common chronic diseases about which special inquiry was to be made. This special information included date of onset of the first symptoms of the disease, their nature, the date first diagnosed, and whether the diagnosis was made by a private physician, at a clinic, or at a hospital. Illnesses that were reported as chronic were asked about on each subsequent visit to the family. Inquiry was made concerning the amount of discomfort and disability suffered from the condition since the last visit and the amount of medical care received for it.

The causes of chronic illness as reported by the family informants were submitted to the attending physicians for confirmation or correction. The cases which had clinic attendance and those which had hospital admissions were also checked against the records of the clinic or hospital where the service was given. The only exception to this procedure was for cases hospitalized outside the City of Baltimore.

The data include "major" chronic conditions reported for persons in families observed two months or longer. Hence the shortest possible period of observation was two months and the longest was from three to five years.

The method of statistical analysis of chronic illness in a longitudinal study such as that in the Eastern Health District of Baltimore has been described fully in a previous paper (1). It has been pointed out also that persons with specific chronic conditions, when observed over a period of time, have the risk of developing other chronic conditions which may or may not be related one to the other (2).

The population considered here is composed of all persons 20 years of age and older and is expressed in person-years of observation. These numbered 17,913. Cases of chronic illness were counted in each year in which they were present. Rates based on cases counted in this manner and on person-years of observation represent an annual prevalence.

Association of Chronic Conditions

The classification "major" chronic disease includes heart

disease, hypertensive vascular disease, arthritis, tuberculosis, diabetes, chronic nephritis, rheumatic fever, varicose veins, chronic gall-bladder disease, syphilis, malignant neoplasm, peptic ulcer, toxic goiter, epilepsy, mental deficiency, psychoses and psychoneuroses, and other important but relatively rare conditions.

When these conditions are arrayed according to the level of their prevalence in the population aged 20 and over, arthritis, heart disease, and diseases of the vascular system are the most important causes of chronic illness. Next in order are the psychoneuroses and nervousness, varicose veins, gall-bladder disease, and diabetes (2). Other conditions were present in the population much less frequently and will not be considered in this analysis.

Table 1 shows the observed and expected number of persons 20 years of age and older with both heart disease and gall-bladder disease and those with both heart disease and diabetes. The expected numbers with both conditions, as shown in Table 1, result from the cross-products of the prevalence rates for each condition. For example, there were 159 cases of gall-bladder disease and 686 cases of heart disease among the 17,913 person-years of observation. The resulting rates were .0089 and .0383, respectively. The cross-product of these rates, .0003, is the rate at which both types of chronic disease would be expected to be present in the same person if

Table 1. Observed and expected number of persons with multiple chronic conditions.

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Heart Disease and Gall-Bladder Disease	11	5.37		
Heart Disease Only	675	680.69	6.18	<.02
Gall-Bladder Disease Only	148	154.05		
Neither Heart Disease nor Gall-Bladder Disease	17,079	17,072.88		
Both Heart Disease and Diabetes	11	5.37		
Heart Disease Only	675	680.69	6.22	<.02
Diabetes Only	144	150.47		
Neither Heart Disease nor Diabetes	17,083	17,076.46		

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Heart Disease and Arthritis	42	32.24	3.22	>.05
Heart Disease Only	644	653.82		
Arthritis Only	793	802.50		
Neither Heart Disease nor Arthritis	16,434	16,424.43		
Both Heart Disease and Varicose Veins	10	8.96	0.12	>.70
Heart Disease Only	676	677.11		
Varicose Veins Only	209	209.58		
Neither Heart Disease nor Varicose Veins	17,018	17,017.35		

Table 2. Observed and expected number of persons with multiple chronic conditions.

such conditions occurred at random in the population. Application of this rate to the 17,913 person-years gives the expected number of 5.37 persons. The observed number was 11.

The chi-square test was then applied to test the hypothesis that the difference between the observed and expected frequencies may be due to chance variation.

Both gall-bladder disease and diabetes showed a statistically significant association with heart disease. The association of diabetes and heart disease is not surprising since heart disease in many instances may represent an advanced degree of vascular degeneration. According to Dolger, premature vascular degeneration is an integral part of the clinical syndrome of diabetes mellitus (3). The reason for the significant association of heart disease with gall-bladder disease seems obscure but will be discussed further in another part of this paper.

Table 2 shows the observed and expected number of persons with both heart disease and arthritis and those with both heart disease and varicose veins. In the experience of this study, neither arthritis nor varicose veins was found to be associated significantly with heart disease.

Table 3 shows the observed and expected number of persons with both hypertensive vascular disease and gall-bladder disease and those with both hypertensive vascular disease and arthritis. In both instances, that of gall-bladder disease and of arthritis, there was a statistically significant association with hypertensive vascular disease. The association of these chronic

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Hypertensive Vascular Disease and Gall-Bladder Disease	8	3.58	5.65	<.02
Hypertensive Vascular Disease Only	411	415.58		
Gall-Bladder Disease Only	151	155.84		
Neither Hypertensive Vascular Disease nor Gall-Bladder Disease	17,343	17,337.99		
Both Hypertensive Vascular Disease and Arthritis	29	19.70	4.71	<.04
Hypertensive Vascular Disease Only	390	399.46		
Arthritis Only	806	815.04		
Neither Hypertensive Vascular Disease nor Arthritis	16,688	16,678.79		

Table 3. Observed and expected number of persons with multiple chronic conditions.

conditions in the same person may be due to the fact that all have been found in many instances to be associated with overweight. Vilter and Thompson have said: "Obesity . . . places an excessive load upon the cardiovascular system and, through this strain, may accentuate hypertension and accelerate the appearance of arteriosclerosis. Excessive weight which must be borne by the large joints of the body accelerates the appearance of hypertrophic arthritis and adds to the suffering of the patient who has rheumatoid arthritis. It also . . . exerts a positive influence upon the occurrence of cholelithiasis and cholecystitis. . . ." (4).

Table 4 shows the degree of association of arthritis and gall-bladder disease and of arthritis with varicose veins. The

Table 4. Observed and expected number of persons with multiple chronic conditions.

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Arthritis and Gall-Bladder Disease	12	7.17	3.47	.07–.06
Arthritis Only	823	827.58		
Gall-Bladder Disease Only	147	152.26		
Neither Arthritis nor Gall-Bladder Disease	16,931	16,925.99		
Both Arthritis and Varicose Veins	6	10.75	2.26	.15–.14
Arthritis Only	829	823.99		
Varicose Veins Only	213	207.79		
Neither Arthritis nor Varicose Veins	16,865	16,870.46		

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Arthritis and Diabetes	8	7.16		
Arthritis Only	827	827.58	.12	>.70
Diabetes Only	147	148.68		
Neither Arthritis nor Diabetes	16,931	16,929.58		
Both Arthritis and Psychoneurosis	12	12.54		
Arthritis Only	823	822.21	.02	>.80
Psychoneurosis Only	269	268.69		
Neither Arthritis nor Psychoneurosis	16,809	16,809.56		

Table 5. Observed and expected number of persons with multiple chronic conditions.

chi-square value, 3.47, for arthritis and gall-bladder disease indicates a probability slightly above the 5 per cent level used as a limit for significance. Arthritis and varicose veins show no significant association.

There is no evidence of a significant association of arthritis and diabetes in the same person. The same was true of the presence of arthritis and psychoneurosis in the same person. In each instance the expected numbers were fairly similar to the observed numbers. These data are shown in Table 5.

Table 6 shows the observed and expected number of persons with psychoneurosis and gall-bladder disease. There the chi-square value, 5.87, indicates a statistically significant association of the two conditions in the same person. The expected number of such instances was approximately 2 and the observed number was 5. The probabilities of such an occurrence being due to normal variation was less than 2 in 100.

It is apparent from the data that certain chronic conditions occur with greater frequency in the same person than would

Table 6. Observed and expected number of persons with multiple chronic conditions.

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Psychoneurosis and Gall-Bladder Disease	5	1.79		
Psychoneurosis Only	276	279.44	5.87	<.02
Gall-Bladder Disease Only	154	157.63		
Neither Psychoneurosis nor Gall-Bladder Disease	17,478	17,474.13		

be expected if such conditions were distributed at random in the population. Those where the association of the two in the same person was found to be statistically significant are as follows: heart disease and gall-bladder disease, heart disease and diabetes, hypertensive vascular disease and gall-bladder disease, hypertensive vascular disease and arthritis, and psychoneurosis and gall-bladder disease. Those where there was no statistically significant association in the occurrence of both in the same person are as follows: heart disease and arthritis, heart disease and varicose veins, arthritis and gall-bladder disease, arthritis and varicose veins, arthritis and diabetes, and arthritis and psychoneurosis (5).

Association of Chronic Conditions and Overweight

At the present time much attention is being drawn to the problem of obesity in the population and its effect upon morbidity and mortality rates. According to Chapman, "Study after study has shown that the mortality rates among obese people are higher than among people of normal weight" (6, 7, 8). It is of definite interest, therefore, to learn what chronic conditions are significantly associated with overweight.

At the end of the third year of the morbidity study in the Eastern Health District of Baltimore, records of height and weight were obtained for the population under observation at that time. Persons who did not know their height or weight were asked to make a special effort to ascertain these facts and report them at the next visit of the investigator. Such records were obtained for 72 per cent of the males and 73 per cent of the females aged 20 and over. Table 7 shows the variation in the proportion at specific ages who reported height and weight. Males varied from 62 per cent at age 65 and over to 82 per cent at ages 25–34. Females varied from 65 per cent at ages 65 and over to 78 per cent at ages 35–44.

Records of height and weight obtained in the manner described are admittedly relatively crude. There was no effort to get height without shoes or weight without clothing. How-

Age Group	Male		Female	
	Number of Persons Observed May and June, 1941	Per Cent with Height and Weight Record	Number of Persons Observed May and June, 1941	Per Cent with Height and Weight Record
20–24	205	73.2	239	66.9
25–34	394	82.0	418	76.3
35–44	358	69.0	371	78.2
45–54	332	69.6	316	76.3
55–64	173	70.5	196	66.3
65+	131	61.8	167	65.3

Table 7. Proportion of the population at specific ages for whom a record of height and weight was obtained.

ever, all records were obtained at the same time, during May or June; thus the effect of different weight of clothes at different seasons is eliminated. These data then represent height and weight for a cross-section of people at a given time.

The standards used for classification of persons according to underweight, normal, or overweight are included in tables produced by the Metropolitan Life Insurance Company: Desirable Weights for Men Aged 25 and Over and Desirable Weights for Women Aged 25 and Over (9). These tables take into account certain physical characteristics which result in variations in body weight and the range of desirable weights are shown at each inch of height for persons of slight, medium, and heavy build. Weights of those of medium build were used for all persons in the study in the Eastern Health District because of lack of information which would enable accurate classification as to type of build. Also, these tables make no distinction of age but apply to all persons 25 years or older.

Table 8 shows the distribution of males and females at specific ages according to their weight classification. Four weight classes are shown: "Underweight" 10 per cent or more below the standard used; "Normal" weight –9 to +9 per cent below or above the standard; "Overweight" from 10–29 per cent above the standard; and "Overweight" 30 or more per cent above the standard used.

Age Group	Total	Underweight 10 Per Cent or More	Normal Weight −9 to +9 Per Cent	Overweight 10-29 Per Cent	Overweight 30+ Per Cent
	Male				
20–24	100.0	14.0	56.0	29.3	0.7
25–34	100.0	7.1	48.9	38.7	5.3
35–44	100.0	3.7	41.3	44.9	10.1
45–54	100.0	4.3	40.7	45.0	10.0
55–64	100.0	6.6	44.6	35.6	13.2
65+	100.0	11.1	46.9	37.0	5.0
	Female				
20–24	100.0	29.4	38.1	21.9	10.6
25–34	100.0	20.9	34.1	29.4	15.6
35–44	100.0	9.3	25.9	37.6	27.2
45–54	100.0	3.7	15.8	37.3	43.2
55–64	100.0	5.3	17.7	38.5	38.5
65+	100.0	16.7	23.1	31.5	28.7

Table 8. Distribution of male and female persons at specific ages according to weight classes.

Among males the proportion classed as "Overweight" increased markedly up to age 54. After age 55 there was a slight decrease, the proportions varying from 42 to 49 per cent thereafter compared with 55 per cent at ages 45–54.

Females were similar to the males in that the proportion of overweight persons increased markedly as age increased. However, from 65 to 80 per cent of the females at ages 35 to 64 were classed as overweight compared with only 49 to 55 per cent of the males at those ages. Moreover, females showed a much greater tendency to very excessive overweight than did the males; that is, 30 per cent or more above the standard used. These data are shown in Column 5 of Table 8.

It may be that inability to take more precise consideration of the factor of variation in body build in relation to weight than was possible in this study may somewhat exaggerate the proportions of persons in the overweight classes. It will be recalled that weight for *medium* body build was used for all persons. However, it is believed that this procedure has not produced a serious discrepancy in the data presented.

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Overweight and Heart Disease	77	57.41	14.20	<.001
Heart Disease Only	37	56.68		
Overweight Only	1,130	1,149.60		
Neither Overweight nor Heart Disease	1,158	1,138.31		
Both Overweight and Hypertensive Vascular Disease	51	38.19	8.86	<.01
Hypertensive Vascular Disease Only	25	37.71		
Overweight Only	1,156	1,168.82		
Neither Overweight nor Hypertensive Vascular Disease	1,170	1,157.28		

Table 9. Observed and expected number of persons who were overweight and had a specific chronic condition.

It is of interest to present data which reveal the association of overweight with various chronic conditions. These data are based upon the records of 2,402 persons for whom a record of height and weight was obtained. The method of analysis is the same as that used to describe the association of specific chronic conditions in the same person. The classification "overweight" includes all persons 10 per cent or more above the standard used.

Table 9 shows the observed and expected number of persons who were both overweight and had heart disease and those who were both overweight and had hypertensive vascular disease. Both of these conditions were significantly associated with overweight. In both instances the observed number with both conditions was considerably greater than the number expected to be present if these conditions occurred at random in the population. Overweight and heart disease were both present in 77 persons compared with an expected number of 57. Both overweight and hypertensive vascular disease were present in the same person in 51 instances compared with an expected number of 38.

Table 10 shows the observed and expected number of persons who were overweight and who also had arthritis. Here again there was a statistically significant association of the two conditions in the same person as revealed by the chi-square

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Overweight and Arthritis	112	81.91	23.90	<.001
Arthritis Only	51	81.19		
Overweight Only	1,095	1,125.10		
Neither Overweight nor Arthritis	1,144	1,113.80		

Table 10. Observed and expected number of persons who were overweight and who had arthritis.

test. The observed number was 112 compared with an expected number of 82.

Both diabetes and gall-bladder disease occur with considerably greater frequency among females than among males. Both are believed to be associated with overweight. Table 11 shows the data for these two conditions among 1,249 females age 20 and over for whom a record of height and weight was obtained. The expected number of women who were both overweight and had diabetes was 10 compared with the observed number of 15. The chi-square value 4.6 indicates that the difference between the observed and expected numbers was beyond the limits of an expected or normal variation. Persons with diabetes are given instruction with regard to the importance of weight control. Since the data presented here are based upon the prevalence of diabetes in the population and include cases diagnosed a number of years before observation, the present association with overweight is of added significance (10).

Chronic gall-bladder disease was found to be associated with

Table 11. Observed and expected number of females who were overweight and who had a specific chronic condition.

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Overweight and Diabetes	15	10.12	4.60	<.05
Diabetes Only	3	6.87		
Overweight Only	728	732.91		
Neither Overweight nor Diabetes	503	499.10		
Both Overweight and Gall-Bladder Disease	26	17.86	9.37	<.01
Gall-Bladder Disease Only	4	12.12		
Overweight Only	717	725.17		
Neither Overweight nor Gall-Bladder Disease	502	493.85		

overweight among females. The chi-square value of 9.37 was higher than those obtained for hypertensive vascular disease and diabetes in relation to overweight.

It is apparent from the data presented here that examination of the experience of a cross-section of a sample population in the Eastern Health District of Baltimore confirms the impressions gained from the practice of clinical medicine. From their experience with patients, physicians have noted that patients with osteoarthritis are usually overweight, gall-bladder disease is usually more common in obese persons, diabetes is associated with obesity, and that hypertensive vascular disease is frequently associated with obesity.

Obesity may then be the predisposing factor which brings about the significant association of certain conditions in the same person. Heart disease and gall-bladder disease may be cited as an example. Study of the overweight population brings out this fact most strikingly.

Table 12 shows the observed and expected number of obese persons with both heart disease and gall-bladder disease and those with both heart disease and diabetes. It will be noted that the chi-square values 20.9 and 21.1 for the two classes of conditions, respectively, are slightly more than three times as high as those shown in Table 1 where the data are based upon the total population aged 20 and over. Thus the significance

Table 12. Observed and expected number of obese persons with multiple chronic conditions.[1]

Classification with Respect to Chronic Conditions	Observed Number	Expected Number	Chi-Square	P
Both Heart Disease and Gall-Bladder Disease	8	1.93	20.90	<.001
Heart Disease Only	83	89.13		
Gall-Bladder Disease Only	20	26.02		
Neither Heart Disease nor Gall-Bladder Disease	1,177	1,170.92		
Both Heart Disease and Diabetes	7	1.55	21.14	<.001
Heart Disease Only	84	89.52		
Diabetes Only	14	19.44		
Neither Heart Disease nor Diabetes	1,183	1,177.49		

[1] Obese persons are those 10 per cent or more overweight.

of the association of these conditions in the same person is greatly strengthened by study of the population classed as obese.

Table 13 shows the observed and expected number of obese persons with both hypertensive vascular disease and gall-bladder disease and those with both hypertensive vascular disease and arthritis. Here again the chi-square values are higher than those obtained by use of the total population. The values 7.4 and 8.2 are 31 and 75 per cent, respectively, above those shown for the same conditions in Table 3.

A comparison of persons classed as overweight and persons not overweight with respect to the number of cases of chronic conditions in each group is of interest. The chronic conditions to be considered include heart disease, hypertensive vascular disease, arthritis, diabetes, gall-bladder disease, and psychoneurosis. Among the persons classed as overweight there were 338 cases of these chronic illnesses; among the persons classed as not overweight there were 153 cases.

Table 14 shows the ratio of the actual number to the expected number of cases of chronic illness among 1,286 obese persons classified by broad age groups. The expected number for each age group was obtained by applying the prevalence

Table 13. Observed and expected number of obese persons with multiple chronic conditions.[1]

Classification with Respect to Chronic Condition	Observed Number	Expected Number	Chi-Square	P
Both Hypertensive Vascular Disease and Gall-Bladder Disease	4	1.16	7.42	<.01
Hypertensive Vascular Disease Only	47	49.85		
Gall-Bladder Disease Only	24	26.79		
Neither Hypertensive Vascular Disease nor Gall-Bladder Disease	1,213	1,210.20		
Both Hypertensive Vascular Disease and Arthritis	10	4.38	8.22	<.01
Hypertensive Vascular Disease Only	41	46.62		
Arthritis Only	99	104.59		
Neither Hypertensive Vascular Disease nor Arthritis	1,138	1,132.41		

[1] Obese persons are those 10 per cent or more overweight.

Age Group	Actual Number	Expected Number	Ratio of Actual to Expected
20–39 Years	38	34.66	1.10
40–59 Years	206	103.53	1.99
60+ Years	94	71.07	1.32

Table 14. Ratio of actual number to the expected number of cases of chronic illness among 1,286 obese persons, classified by age.

rate of chronic illness noted at that age for persons who were not 10 per cent or more overweight to the population composed of those considered as obese. At ages 20–29 the actual number exceeded the expected by 10 per cent. In the middle-age period, ages 40–59, the actual number of cases of chronic illness among obese persons was almost double the expected number. Even in the old-age group, 60 years or older, there was a marked excess in the actual numbers compared with the expected. It may be concluded from these data that obesity adds greatly to the risk of chronic illness, especially among persons of middle age or of old age.

Summary

Data presented in this report indicate that certain chronic conditions occur with greater frequency in the same person than would be expected if such conditions were distributed at random in the population.

Those where the association of the two in the same person was found to be statistically significant are as follows: heart disease and gall-bladder disease, heart disease and diabetes, hypertensive vascular disease and arthritis, and psychoneurosis and gall-bladder disease.

Those where there was no statistically significant association in the occurrence of both in the same person are as follows: heart disease and arthritis, heart disease and varicose veins, arthritis and gall-bladder disease, arthritis and varicose veins, arthritis and diabetes, and arthritis and psychoneurosis.

The chronic conditions found to be significantly associated with overweight, 10 per cent or more above the standard used,

are heart disease, hypertensive vascular disease, arthritis, diabetes, and gall-bladder disease.

Study of the overweight population brought out the fact that obesity may be the predisposing factor which brings about the significant association of certain conditions in the same person.

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DISABILITY FROM RESPIRATORY ILLNESS

DORIS TUCHER AND JEAN DOWNES[1]

ACUTE respiratory illness is an important cause of disability. One study has shown that respiratory diseases accounted for 50–60 per cent of the disabling illnesses and approximately 40 per cent of the disabling days from acute illness among employed males and females (1). The term "disabling illness" is generally defined as an illness which caused an interruption in the usual daily activities. Obviously such a definition is not completely objective because personal attitudes and feelings about how illness should be cared for may determine whether a specific illness is considered disabling. It is of interest, therefore, to learn whether disabling illness is characteristic of certain people or whether such illness is distributed at random throughout the population.

This report presents the results of an inquiry into this particular problem. It is based upon the illness experience in families in two communities in Westchester County, New York, over the three-year period, 1946–1949.

DATA AND METHOD OF STUDY

The data and method of the study of acute respiratory illness in the two communities in Westchester County, New York, have been fully described in previous reports (2, 3, 4, 5). Briefly, the epidemiological field investigation of respiratory illness was based upon the periodic survey of families for the purpose of collection of illness records. All families in which there were one or more children attending grade school or high school in each of the two communities were included in the study. These families were visited every twenty-eight days during the three school years September–June, 1946–1949. On each visit to the family, inquiry was made about acute respiratory illnesses which had occurred among their members during the past four weeks. Inquiry was also made as to whether

[1] From the Milbank Memorial Fund. This is the ninth in a series of papers dealing with a study of respiratory illness.

the reported illness caused any disability or interfered with the person's usual activities.

The sample population used in this analysis consists of persons in 497 families observed for at least thirty weeks in each of the three successive school years of the study. The families may be described as simple units, that is, they included only those composed of a husband and wife and their children. From these families four population groups were drawn for special study: (1) children aged 5–9; (2) children aged 13–17; (3) husbands; and (4) wives.

Acute respiratory illness in this study includes head colds or coryza, colds with sore throat, tonsillitis, and septic sore throat, colds with chest complications such as tracheitis, bronchitis, or cough and influenza.

Table 1. Distribution of 393 children aged 5–9 and 279 children aged 13–17 according to their illness classification in specific school years, September to June, 1946–1949.

Illness Classification	First Year (1946–1947)	Second Year (1947–1948)	Third Year (1948–1949)
	Per Cent		
	age 5–9		
Total	100.0	100.0	100.0
Persons Who had:			
No Illness	13.0	16.8	22.4
Only Nondisabling Illness	11.9	12.7	10.9
Both Disabling and Nondisabling Illness	35.9	26.2	27.2
Only Disabling Illness	39.2	44.3	39.5
	age 13–17		
Total	100.0	100.0	100.0
Persons Who Had:			
No Illness	30.5	35.5	34.8
Only Nondisabling Illness	19.3	19.0	19.7
Both Disabling and Nondisabling Illness	26.2	18.6	17.6
Only Disabling Illness	24.0	26.9	27.9

Disabling Illness Experience

The population studied consisted of 497 husbands and their wives, 393 children aged 5–9, and 279 children aged 13–17. The children are classed according to age during the first year of observation.

Table 1 shows the distribution of the children aged 5–9 and those 13–17 in each of the school years according to their illness classification in the specific year. The proportion of children aged 5–9 who had no illness increased from 13 per cent in the first year to 22 per cent in the third year. The proportion for whom only nondisabling illness was reported remained remarkably constant in all three years. Also, the proportion of the total children for whom only disabling illness was reported remained fairly constant in each year. The distribution

Table 2. Distribution of 497 wives and 497 husbands according to their illness classification in specific school years, September to June, 1946–1949.

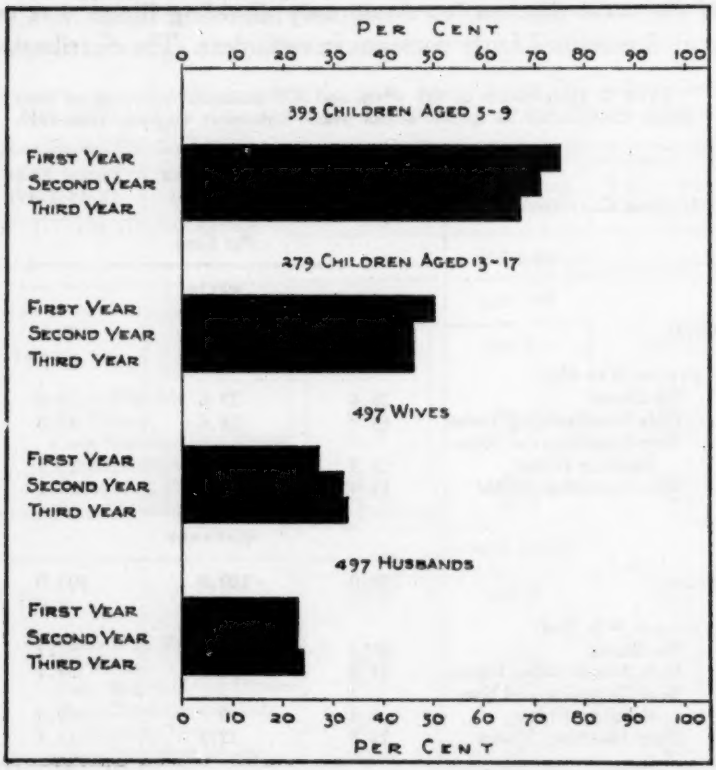
Illness Classification	First Year (1946–1947)	Second Year (1947–1948)	Third Year (1948–1949)
	Per Cent		
	WIVES		
Total	100.0	100.0	100.0
Persons Who Had:			
No Illness	28.4	29.6	31.4
Only Nondisabling Illness	44.9	38.6	36.0
Both Disabling and Nondisabling Illness	15.3	15.5	17.5
Only Disabling Illness	11.4	16.3	15.1
	HUSBANDS		
Total	100.0	100.0	100.0
Persons Who Had:			
No Illness	46.1	52.5	52.1
Only Nondisabling Illness	31.0	24.5	24.1
Both Disabling and Nondisabling Illness	8.4	10.7	10.3
Only Disabling Illness	14.5	12.3	13.5

of children aged 13–17 according to illness class was also similar from year to year.

Table 2 shows the distribution of husbands and wives according to their illness classification in specific years. Again there is relatively little change over the three-year period in the proportions in the various illness classes. For example, from 28 to 31 per cent of the wives reported no respiratory illness and from 46 to 52 per cent of the husbands were in that class.

In all four population groups studied, that is, children aged 5–9, those aged 13–17, husbands, and their wives, there was

Fig. 1. Per cent of persons at certain ages who suffered one or more disabling illnesses in specific years.



little change over the three-year period in the proportion who had one or more disabling illnesses. This fact is illustrated by Figure 1. These data lead to the question: Is disabling illness from respiratory diseases more characteristic of some people than of others, or is such illness distributed at random throughout the population? This question can be studied if a population is observed over a sufficient period of time, that is, over several successive years.

For purposes of inquiry into the question raised, two groups were drawn from the population presented in this report. One was composed of children in the age groups 5–9 and 13–17; these numbered 367. The other group was composed of 353 husbands and wives. All of the persons in each of the two groups reported one or more respiratory illnesses in each of the three years. This procedure affords a homogeneous population in that all were at risk in each year of suffering some disability from respiratory disease.

Table 3 shows for the two population groups the per cent of persons in each year who suffered some disabling illness. In each population group the proportions are quite similar year by year. From 81 to 86 per cent of the children had some disabling illness and from 42 to 50 per cent of the husbands and wives were in that classification.

Table 4 shows the observed and the expected number of persons who reported disabling illness in all three years. The expected number of persons with some disability in all three

Table 3. Per cent of persons who had one or more attacks of disabling illness at some time during the specified year, September to June, 1946–1949.[1]

Classification	Number of Persons	First Year (1946–1947)	Second Year (1947–1948)	Third Year (1948–1949)
		Per Cent		
Children	367	85.56	83.38	80.65
Husbands and Wives	353	41.93	45.89	50.14

[1] Only persons who were ill in each of three years and were therefore at risk of disability were included.

Illness Class	Children		Husbands and Wives	
	Observed Number	Expected Number	Observed Number	Expected Number
Disability at Some Time in all 3 Years	235	211.17	57	34.06
No Disability in Any of the 3 Years	8	1.69	83	55.31
Disability Some Time in Only 1 or 2 Years	124	154.14	213	263.62
Chi-Square	32.18		39.01	
P	<.001		<.001	

Table 4. Observed and expected number of persons who were disabled at some time in all three years and who were not disabled in all three years, September to June, 1946–1949.

years results from the cross-products of the proportions shown in Table 3. For example, the cross-product of the proportions noted for the children, .5754, indicates the per cent which would be expected to be disabled in all three years if disability from respiratory illness occured at random in this particular child population. Application of this per cent to the 367 children gives the expected number, 211.17. The observed number was 235. The expected number of persons with no disability in any of the three years was obtained by application of the cross-products of the per cent not disabled in each year.

The chi-square test was then applied to test the hypothesis that the difference between the observed and expected frequencies may result from the operation of chance alone.

The chi-square values shown in the lower part of Table 4 are statistically significant and they indicate that some factor other than a normal or expected variation is responsible for the differences between the observed and expected number of persons in the various illness classes. Evidently disability from respiratory disease is a characteristic of certain persons. The fact that this was true of both children and adults is of special interest.

Disabling illness is not only a characteristic of certain persons but may also be characteristic of certain families. This

fact may be illustrated by examination of the families of the 353 husbands and wives who suffered one or more respiratory illnesses in each of the three successive years. The fifty-seven husbands and wives who suffered some disability in all three years were in fifty-three different families. The remaining 296 were in 203 families.

Table 5. Distribution of children according to age in two groups of families.

Age Group	134 Children in 53 Families	450 Children in 203 Families
0–4	22.4	22.4
5–9	35.1	35.1
10–14	26.8	28.0
15–18	15.7	14.5

Families in each of the two groups were classed according to whether disabling illness seemed to be a family characteristic, that is, whether 50 per cent or more of the other members of the family suffered some disabling illness in each of the three years of observation. Disabling illness was found to be characteristic of thirty-eight, or 72 per cent, of the fifty-three families where one or both spouses had some disabling illness in each year. On the other hand, in only ninety-seven, or 48 per cent, of the 203 families was disabling illness found to be typical of the family members.

The difference between the two groups of families with respect to disabling illness was not due to differences in the age of the children. This is illustrated by Table 5 which shows that the age distribution of the children in the two groups was strikingly similar.

It seems reasonable to conclude that disability from respiratory illness is characteristic of certain persons, among both children and adults, and is also typical of certain families.

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SOME DEMOGRAPHIC ASPECTS OF A RURAL AREA IN IRAN

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DURING the year 1950, the Department of Rural Health Development[1] of the Iranian Ministry of Health conducted a survey in 173 villages of an agricultural region immediately southwest of the city of Tehran. These villages were intended to be a demonstration area for the training of public health personnel. Reliable data concerning the inhabitants of the region were not available in the official government archives; therefore, a survey of certain health and demographic aspects was indicated. This was to be the first step in the development of a broad training program.

With the help of a physician assigned to the Department by the Ministry of Health, a staff of enumerators was recruited from a group of recently graduated Persian midwives. After six weeks of seminars and lectures on the broad phases of public health and preventive medicine, eight of the midwife-trainees were selected for appointment to the staff. During the following four months these girls were given additional training both in the lecture room and in the field. Emphasis was placed on survey techniques and the reasons for collecting each type of information. A preliminary survey form was prepared and tested by field trials. After an analysis of these data, the form was modified and the general survey was started.

The information which was sought fell into three distinct categories: (a) data on individuals in each household, i.e., their occupation, age, sex, and the presence or absence of certain diseases and habits; (b) data on the environment in which members of the household lived; and (c) data on pregnancies which occurred among the women of each household during the ten years prior to the survey. This paper is primarily con-

[1] An experimental agency of the Iranian Ministry of Health working in cooperation with the University of Tehran Medical Faculty and the International Health Division of The Rockefeller Foundation.

Sheet No.													
Name													
Age													
No. of Pregnancies 1319–28													
No. of Premature													
No. of Full-Term													
No. of Abortions													
No. of Live Births 1319–28													
No. of Stillbirths													
No. Living													
No. Dead													
No. Dying at	<1 Month												
	<1 Year												
	>1 Year												
No. Dying in First Year from	Dysentery												
	Resp. Infection												
	Tetanus												
	Syphilis												
	Premature												
	Other Causes												
No. of Deliveries Attended by	Physician												
	Midwife												
	Other												
No. of Deliveries at	Hospital												
	Home												
No. of Years Married													
No. of Years Exposure													
Observations													

Figure 1. Obstetrical and infant data. (Reproduced from Health Survey Form utilized in Shahriar Area—1950.)

cerned with the last item, since, up to the time of the survey, data of this type for Iran were not available.

Survey Technique

1. *Sampling.* Each of the villages, varying in population from 50 to 3,500, with an average of 260 inhabitants, was visited initially by one of the two sanitarians on the staff. The location of family units was determined, and each dwelling was assigned a number which was clearly marked on the wall or gate with red paint. When the enumerators arrived in the village, they interviewed only those families who lived in households marked with the number five or multiples of five. Frequently, one of the selected families was absent at the time of the survey. In this case the enumerators were instructed to pick at random one of the households numerically closest, above or below, the missing one and to revert to the original sequence with the next family interviewed. Data were obtained from any member of the family present at the time but included information on those absent as well. For the most part the respondents were adult women, but other members of the family who happened to be present helped to verify the data. Each household was visited only once during the survey.

2. *Recording.* That portion of the form dealing with pregnancies and their outcome is reproduced in Figure 1. Here were recorded the names of any women in the household who had had pregnancies, or who might have had pregnancies (i.e., those who were married though childless) during the ten years prior to the survey. The rest of the process was merely a matter of placing numerical figures in the appropriate columns. Under "Observations," pertinent comments or explanations were noted either in the local language (Farsee) or in English, depending on the enumerator's bilingual capacity.

3. *Qualifications.* It will be noted that only those pregnancies which occurred within the ten-year period prior to the survey were recorded. This time span was, in a sense, a compromise. It was felt that memory of events would be better for this period than for the entire reproductive life, and that

the number of pregnancies would be sufficiently large to be statistically significant. While greater accuracy might have been achieved by utilizing a one-year or two-year period prior to the survey, the advantage of having larger numbers and a more solid baseline outweighed the disadvantages. It is true that in lumping together all of the data from the ten-year period, two broad assumptions were made: first, that conditions pertaining to pregnancies and their outcome remained relatively constant; second, that the population was stable. Each of these assumptions seems reasonable, both in the light of general information about the region and in view of the fact that the objective of the study was to obtain data which would indicate an "order of magnitude" rather than an absolute quantification. It was recognized that the survey method, of itself, could provide no more than a general conception of existing conditions, but that this was better than nothing and would have to suffice until the local government could organize its own system for collecting reliable statistics.

4. *Definitions.* As far as definitions were concerned, it was obvious that the concepts of prematurity, abortion, and stillbirth had to be those defined by the women themselves rather than by standards adopted in countries where more and better medical care is available. *Prematurity,* for instance, depended on the mother's subjective interpretation as to whether or not a given infant happened to have been born smaller or earlier than expected. *Abortions* were even harder to pin down. Sometimes the products of conception were not recognized as such when passed. At other times, an unduly copious flow at the regular menstrual period might have been considered an abortion when, in fact, it was not. It is probable, however, that the frequency of abortions occurring in this population was much greater than the actual number stated. No attempt was made to distinguish between abortions and miscarriages.

If a baby breathed after delivery, it was considered to be a *live birth,* regardless of how soon thereafter it died. *Stillbirths* were defined as babies of normal or subnormal size who never

breathed after delivery. The "*number living*" referred to children who were born during the ten-year period and who were still alive. Conversely, the "*number dead*" referred to those who were born alive during the period and subsequently died.

The various categories on the cause of death of infants were quite unsatisfactory. The majority were recorded as having died of "other causes," and only in a few cases was there any reliable indication of a specific etiological agent. Autopsies are rare even in urban centers; thus, no pathological diagnoses were established.

When it came to the subject of assistance at the deliveries, the categories of physicians included both graduate doctors and "Behdars" (assistant doctors), who are limited by law to practice in localities with a population of less than 10,000. Graduate midwives are almost nonexistent in the area, and it was necessary to consider a midwife to be any woman who assisted at deliveries for profit. Among "others" were included deliveries which were either unattended or were assisted by a neighbor on a gratuitous basis.

5. *Statistical Considerations.* In obtaining the numerators for the infant mortality rates, there probably were errors in interpreting actual age at which a child died. A most important source of bias, in the direction of underreporting, resulted when the mother thought a child was "about one year old" at the time of death. Failing more specific details, these deaths were automatically included in the group dying at more than one year rather than in the infant group. An unknown degree of bias in the same direction involved children who died in infancy and were completely forgotten by the mother—thus not recorded. This probably occurred more often in the early portion of the ten-year period, memory of which was less precise. Failure to include such infants affected the reported birth rate, but, more profoundly, the infant mortality rate. A third source of bias arose from the fact that infants born a short period prior to the survey had not been exposed a full year to the risk of dying.

It will be noted that there are occasional discrepancies in the totals. This is due to the fact that whenever information regarding a particular item was lacking or doubtful, a question mark was recorded instead of an actual figure. In compiling the results, any questionable item was excluded from both the numerator and denominator. This procedure in no way affects the general validity of the rates but leads to totals which are not consistent throughout.

Results

In a consideration of birth rates, factors such as age distribution of the population, sex ratios, and marital status must be taken into account for they have a direct bearing on the number of children produced.

Age Distribution. The distribution of the surveyed population by age and sex is shown in Table 1. The errors implicit in any census were undoubtedly present; e.g., there was the usual "heaping" at ages which were multiples of five, and the number of children under one year of age was probably underreported. Also, there was an even greater degree of inaccuracy regarding the age of older persons than would be expected in a more enlightened population. Hence, it seemed advisable to group together all those with a stated age of 45 or over. When

Table 1. Distribution of population, by age groups and sex.

Age Group	Total		Males		Females	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Under 1	382	4.2	195	4.3	187	4.2
1–4	1,164	12.9	579	12.7	585	13.1
5–9	1,315	14.6	673	14.7	642	14.4
10–14	1,043	11.5	550	12.0	493	11.1
15–19	839	9.3	395	8.6	444	10.0
20–24	733	8.1	294	6.4	439	9.9
25–34	1,137	12.6	558	12.2	579	13.0
35–44	1,010	11.2	560	12.2	450	10.1
45+	1,400	15.5	768	16.8	632	14.2
Undetermined	7	0.1	6	0.1	1	–
Total	9,030	100.0	4,578	100.0	4,452	100.0

a given age seemed disparate with physical appearance, the individual was asked about personal memory of well-known historic events which would tend to verify or invalidate the statement.

Table 1 reveals that 42.9 per cent of the female population were of childbearing age (i.e., 15 to 44). The fact that only 14.2 per cent of the females were 45 years of age and over indicates that the population was essentially young.

Sex Ratios. When one compares the male-female ratio in each age group, as shown in Table 2, one notes that in Iran there are relatively fewer males than females between the ages of 15 and 34 and that the ratio reverses sharply for the age groups 35 and over. There are several plausible explanations. There may have been a shift to the older age groups on the part of males who misstated their actual age in order to avoid military conscription. Another possibility is that the predominance of males in the older groups represents the true state of affairs and that the women from the rural area under study

Table 2. Number of males per 100 females for selected populations, in Iran, Egypt, and India, by age groups.

Age Group	Iran Village Survey, 1950	Egypt 1937[1]	Egypt Village Survey, 1950[2]	India 1931[3]	India Assam Tea Estates, 1950[4]
Under 1	104.3	99.5	75.0	98.9	94.1
1–4	99.0	92.6	116.7	97.6	
5–9	104.8	100.6	114.3	109.9	102.5
10–14	111.6	117.4	140.0	113.6	122.1
15–19	89.0	112.7	72.7	101.1	90.8
20–24	67.0	95.5	95.2	97.7	73.5
25–34	96.4	88.5	77.6	107.5	103.4
35–44	124.4	106.2	119.2	114.7	142.2
45+	121.5	96.5	83.9	108.8	158.1
Total Group	102.8	100.2	95.6	106.4	109.6

[1] Based on figures taken from: United Nations Statistical Office Demographic Yearbook 1949–50. New York, 1950. Table 4, page 104.
[2] Sindbis Health Center, Egypt. Annual Report for 1950 by Dr. J. M. Weir to The Rockefeller Foundation. Unpublished data.
[3] Based on figures taken from: United Nations Statistical Office Demographic Yearbook 1949–50. New York, 1950. Table 4, page 127.
[4] A. B. Gilroy. The Age and Sex Composition of Tea Estate Populations in Assam. Typewritten report. The Ross Institute of Tropical Hygiene, India and Pakistan Branch (1950).

may actually die earlier than the males. Conclusive evidence one way or the other is lacking, but the social and economic environment is such that women over the age of 45 have, in a sense, outlived their usefulness and may consequently receive less consideration when afflicted by illness or other vicissitudes of old age. Also, one wonders whether the relatively smaller number of females in the 35-plus age groups might not reflect a high maternal mortality.

The relative dearth of males in the 15 to 24 age groups might possibly be explained on any one of three bases: (1) A considerable proportion may have actually been in uniform; (2) The very threat of military service may have prompted some to misstate their age; (3) Conditions in the villages are such that there has been an apparent migration of young males toward the urban centers in order to find employment.

For purposes of comparison, Table 2 also shows the sex ratios in different age groups for Egypt and India, as reported in

Table 3. Marital status of surveyed population ten years of age and over, by age groups and sex.

Age Group	Males					Females				
	Total	Single	Married	Widowed	Divorced	Total	Single	Married	Widowed	Divorced
	Number									
10–14	550	550				493	484	9		
15–19	395	386	9			444	210	230	2	2
20–24	294	182	111	1		439	16	409	7	7
25–34	558	79	472	5	2	579	5	556	13	5
35–44	560	8	543	6	3	450	1	405	42	2
45+	773	4	741	25	3	633	4	306	310	13
Total	3,130	1,209	1,876	37	8	3,038	720	1,915	374	29
	Per cent									
10–14	100.0	100.0				100.0	98.2	1.8		
15–19	100.0	97.7	2.3			100.0	47.2	51.8	0.5	0.5
20–24	100.0	61.9	37.8	0.3		100.0	3.6	93.2	1.6	1.6
25–34	100.0	14.2	84.6	0.9	0.3	100.0	0.9	96.0	2.2	0.9
35–44	100.0	1.4	97.0	1.1	0.5	100.0	0.2	90.0	9.3	0.5
45+	100.0	0.5	95.9	3.2	0.4	100.0	0.6	48.3	49.0	2.1
Total Group	100.0	38.6	59.9	1.2	0.3	100.0	23.7	63.0	12.3	1.0

official censuses and for two areas where special studies were made (an Egyptian village and tea estates in Assam, India). The figures were essentially comparable, and it was interesting to note that the ratios of males to females in the 15 to 24 age groups were fairly similar to those noted in the Iran village survey.

Marital Status. Table 3 shows the marital status of the surveyed population of ten years of age and over. The important feature bearing directly on the birth rate is that in the age group 45 and over, all but 0.6 per cent of those still living were, or had been, married. It is also apparent that even with a law prohibiting marriage before the age of 16, the females marry earlier than the males. In the 20–24 age group only 3.6 per cent of the females were still single, as contrasted with 61.9 per cent of the males. Another striking feature is the number of widowed females in the age group 45 and over. In part this may be explained by the hypothesis that in the eyes of potential husbands, widows over the age of 45 present a less appealing prospect than their younger sisters.

It should also be mentioned that both divorce and polygamy are permitted by the Moslem religion, subject to certain conditions. Actually the proportion of divorces and the number of married men with more than one wife is low, probably owing to economic factors.

Other Factors. There are, of course, numerous additional factors which affect the over-all birth rate. These include social customs, the practice of contraception, age-specific mortality rates among the females, morbidity of certain diseases, nutritional status, and others. The relative importance of these factors was not studied.

Data Relating to Pregnancies, Births, and Infant Deaths

It was found that 1,616 of the women surveyed had had one or more gestations during the ten-year period prior to the survey. The data relating to these gestations are shown in Table 4.

The observed birth rate of 51.4 per 1,000 population is in

marked contrast to the rate of 20 for the entire country reported in the official statistics of the Iranian Government. The former rate, however, which represented an average annual rate over the ten-year period prior to the survey, checked closely with the observed number of children in the surveyed population under the age of one year after a deduction was made for infant mortality. Even the relatively high observed rate of 51.4 per 1,000 population is probably understated for at least two reasons: (1) Only those women who survived could be interrogated; thus, live births occurring during the ten-year period to women who died prior to the survey were automatically excluded. There is evidence (Table 1) that this

Table 4. Data relating to pregnancies, births, and infant deaths among sampled population during the ten years prior to the survey.[1]

Total Number of Pregnancies during the Period	5,146	
Number of Full-Term	4,567	
Number of Abortions	438	
Number of Prematures	134	
Number Undetermined	7	
Number of Live Births during the Period	4,645	BIRTH RATE: $\frac{4,645}{9,030} \times \frac{1,000}{10} = 51.4$ per 1,000 Population
Stillbirths	93	STILLBIRTH RATIO: $\frac{93}{4,645} \times 1,000 = 20.0$ per 1,000 Live Births
Number of Children Living (of Live Births during Period)	2,992	
Number of Children Dead (of Live Births during Period)	1,656	
Number Dying Under 1 Month	402	NEONATAL MORTALITY RATE: $\frac{402}{4,645} \times 1,000 = 86.5$ per 1,000 Live Births
Number Dying Under 1 Year	1,007	INFANT MORTALITY RATE: $\frac{1,007}{4,645} \times 1,000 = 216.8$ per 1,000 Live Births
Number Dying Over 1 Year	649	

[1] Based on data from 1,616 women who had had one or more pregnancies during the period.

was frequently the case, although no factual data on age-specific death rates were collected. (2) Undoubtedly there were some live births which escaped the mothers' memory.

The ratio of the number of abortions to the total number of pregnancies is much lower than might be expected, by comparison with data for the United States. It is conceded that a considerable number of abortions occurring to these rural women went unnoticed or were ignored.

The relatively low stillbirth ratio may represent a faulty memory on the part of the mother and may be tied in with the fact that there were slightly fewer multiple births than expected. In the case where one of twins was a live birth and the other was stillborn, the latter was liable to be ignored.

The neonatal and infant mortality rates were actually lower than expected on the basis of prior hearsay which had suggested that the infant mortality rate might range from 300 to 500 per 1,000 live births. Although the number of infant deaths was undoubtedly underreported, the degree of underreporting is difficult to estimate. There is reason to believe that infant mortality is higher in other parts of Iran, particularly in the South, although there are no supporting factual data. It should be emphasized here that the rates in this survey are indicative of the surveyed area only and do not apply necessarily to the country as a whole.

Causes of Deaths Among Infants. As mentioned previously, the data relating to the causes of death among infants were in a sense unsatisfactory, for in more than 50 per cent of the cases the exact cause was not specified. It is perhaps unreasonable to hope that accurate data in this regard could be obtained under the circumstances prevailing in the rural areas. The lack of medical care militated against both diagnosis and treatment and the causes of the majority of deaths had to be recorded in the mother's own words: blueness, choking, fever, etc.

About 3 per cent of the infant deaths were ascribed to tetanus, probably of the newborn. This figure seems low when one considers that 99 per cent of the deliveries took place in

Table 5. Relationship between number of pregnancies and woman exposure-years.

Total Years of Exposure[1]	Ages at the Time of the Survey												Total			Total No. of Women in Survey
	14–23			24–33			34–43			44–55						
	No. of Woman Exposure-Years	No. of Pregnancies	Pregnancies per Woman Exposure-Year	No. of Woman Exposure-Years	No. of Pregnancies	Pregnancies per Woman Exposure-Year	No. of Woman Exposure-Years	No. of Pregnancies	Pregnancies per Woman Exposure-Year	No. of Woman Exposure-Years	No. of Pregnancies	Pregnancies per Woman Exposure-Year	No. of Woman Exposure-Years	No. of Pregnancies	Pregnancies per Woman Exposure-Year	
0	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	162
1	68	16	0.24	1	0	0.00	1	1	1.00	4	2	0.50	74	19	0.26	74
2	130	55	0.42	18	8	0.44	6	3	0.50	16	2	0.12	170	68	0.40	85
3	282	108	0.38	21	11	0.52	24	14	0.58	51	12	0.24	378	145	0.38	126
4	284	123	0.43	36	23	0.64	12	6	0.50	32	2	0.06	364	154	0.42	91
5	285	108	0.38	115	50	0.43	30	14	0.47	510	81	0.16	940	253	0.27	188
6	606	252	0.42	150	68	0.45	84	35	0.42	36	5	0.14	876	360	0.41	146
7	266	115	0.43	287	129	0.45	70	24	0.34	105	22	0.21	728	290	0.40	104
8	360	133	0.37	408	172	0.42	80	28	0.35	56	8	0.14	904	341	0.38	113
9	144	53	0.37	414	176	0.43	261	78	0.30	171	47	0.27	990	354	0.36	110
10				3,980	1,641	0.41	3,540	1,233	0.35	1,250	252	0.20	8,770	3,126	0.36	877
Total	2,425	963	0.40	5,430	2,278	0.42	4,108	1,436	0.35	2,231	433	0.19	14,194	5,110	0.36	2,076

[1] Calculated to the nearest whole year.

N. B. The above rates represent a composite of the total experience of each of the women surveyed and should not be confused with intermediate duration-specific data.

the home and were attended by untrained village women who had no concept of cleanliness in obstetrical practice.

Pregnancy Data

In addition to the data regarding pregnancies, births, infant mortalities, etc., information was collected as to the number of years of the ten-year period during which each woman was actually married and living with her husband. The purpose was to arrive at a figure which would express the fecundity of the village women in terms more precise than the usual crude or age-specific fertility rates. This rate was intended to be a rough measure of the capacity of the rural women to conceive —a physiological rather than a demographic expression of fertility. The numerator was composed of pregnancies instead of live births. The denominator was in terms of the number of woman exposure-years, taking into consideration only those years during the ten-year span in which each woman was actually married and was at the same time between the ages of 14 and 45 inclusive. The latter was arbitrarily selected as the normal reproductive period. In accordance with these criteria the data were subdivided in order to compare the pregnancy experience of women in four different age groups. The tabulations are shown in Table 5. Of the 2,076 women entered in the records for possible inclusion in this aspect of the study, 162 were recorded as not having been exposed to pregnancy during the period. This left a total of 1,914 women who amassed 14,194 woman exposure-years. Of these women, 311 never recognizably conceived while the remaining 1,603 women provided 5,110 pregnancies. As shown in Table 5, this represents an average of 0.36 pregnancies per woman exposure-year. Expressed in other terms, this figure indicates that the average woman, if constantly exposed during her entire reproductive life, would have eleven pregnancies.

The table also shows a higher pregnancy rate among women who were in the 24–33 age group *at the time of the survey* than among the others. The lowest rate was found in the oldest age

group despite the fact that 40 per cent of the exposed women in the group had had a full ten years of exposure during the given period. Here it should be emphasized that women who were not exposed at any time during that interval were excluded from the calculations.

There is probably a bias inherent in the methodology leading to rates which run too low in the youngest age group and too high in the oldest. These difficulties could be avoided in any future study by obtaining data on the age of the women at the time of each pregnancy as well as at the time of the survey. With such information at hand, one could obtain not only more exact rates for age-specific pregnancy but also an estimate of the spacing of pregnancies in different age groups and for different periods of exposure.

Interestingly, except for the first year of exposure where the numbers involved were too small to be significant, the *rate* of pregnancies per exposure-year remained almost constant within each separate age group, regardless of the number of years exposed. The aggregate of all age groups did indicate a drop at the fifth year, owing to the disproportionately large number of married women in the 44–55 age group who probably stated their age as 50 and were thus credited with five years of exposure provided that they had been living constantly with their husbands during the first half of the previous decade. Since the pregnancy rates were lowest in this age group, the average was heavily weighted. By substituting a calculated five-year "moving average" the distortion can be eliminated. It is clear that there is need for caution in interpreting the stated age in an older population of this type.

Conversion of Data into Standard Measurements of Fertility. The problem arises as to how to compare these data with fertility studies carried out in other parts of the world. In the first place, the manner in which the original material was recorded does not permit age-specific analysis in the strict sense of the word, for the age groups pertained to women at the time the survey was made, while the pregnancies covered

a span of the preceding ten years. For purposes of internal comparison, however, a rough measure of differential fertility at various stages in the reproductive life is afforded.

With the aid of a few broad assumptions it is possible to compare these data with other studies. If one may assume that the observed ratio of live births to pregnancies was constant

Table 6. Methodology and data used in computing the gross reproduction rate.

Age Group at Time of Survey	Observed Number of Pregnancies in the Ten-Year Period[1]	Calculated No. of Live Births per Year (2) × 0.903 ÷ 10[2]	Calculated No. of Female Births (3) × 0.49[2]	No. of Females in the Population	Annual Births of Daughters per Woman (4) ÷ (5)	No. of Years in Age Group	Annual Births of Daughters per Woman, per Age Group (6) × (7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
14–23	963	86.96	42.61	930	0.04582	10	0.4582
24–33	2,278	205.70	100.79	617	0.16335	10	1.6335
34–43	1,436	129.67	63.54	459	0.13843	10	1.3843
44–55	433	39.10	19.16	461	0.04156	12	0.4987
Total	5,110			2,467			3.9747

Crude Birth Rate: $\frac{\text{Total live births}}{\text{Total population}} = \frac{4,645}{9,030} \times \frac{1}{10} \times 1,000 = 51.4$ (From Table 4)

Number of children 0–4 years per 1,000 women 15–44 inclusive $= \frac{1,546}{1,912} = 808.6$ (From Table 1)

General Fertility Rate: $\frac{\text{Total live births}}{\text{Females 15–44}} = \frac{4,645}{1,912} \times \frac{1}{10} \times 1,000 = 242.9$

Gross Reproduction Rate: Number of female children born per woman assuming span of reproductivity of 14–45 inclusive = 3.97

[1] Taken from Table 5. Since women with an undetermined number of years of exposure were omitted, the total does not agree with that in Table 4.

[2] Data used in calculating fertility rates:

Ratio of births to pregnancies over the 10-year period $= \frac{\text{Total live births}}{\text{Total pregnancies}} = \frac{4,645}{5,146} = 90.3$ per cent (From Table 4)

Sex Ratio (children under 1) $= \frac{\text{Females}}{\text{Total}} = \frac{187}{382} = 0.490$ per cent (From Table 1)

throughout the reproductive period, regardless of age, one can apply this ratio to the observed number of pregnancies and calculate the probable number of live births occurring in each age group. In this way a gross reproduction rate can be computed as shown in Table 6. This was found to be 3.97.

There were insufficient data to calculate a net reproduction rate.[2] The latter takes into account the age-specific mortality of females after birth, which, in turn, can only be derived from a life table. Since there is no life table for Iran, an attempt was made to interpose survival data for females from another country which might be considered similar to Iran in so far as conditions affecting mortality are concerned. For this purpose Egypt was chosen. Data for 1936–38 from Egypt[3] were applied to the Iranian survey figures and an estimated net reproduction rate of 2.24 was derived. Arbitrarily this figure seemed high and the method was tested by applying life table data, also from Egypt (1927–1937), but from a different source.[4] This resulted in a net reproduction rate of 1.72. Still another net reproduction rate, namely 1.25, was obtained by using the 1951 age-specific death rates and calculated survival figures for females in the Egyptian village Sindbis (total population, 4,232).[5]

It is obvious that the results varied widely depending on which set of survival data was utilized. Each source has its own claim to accuracy. For this reason it seems presumptuous to select one and, by applying it to the survey data, draw con-

[2] To paraphrase, the *Gross Reproduction Rate* is an estimate of the average number of live female births produced per woman, assuming that she is alive during her entire reproductive period. The *Net Reproduction Rate* is a refinement of the *GRR,* which takes into account the fact that many females neither reach nor live through the entire reproductive period, with the result that relatively fewer live female births are produced. The appropriate calculations are based on age-specific birth and mortality rates.

[3] Survivors at Specified Ages for Each Sex. United Nations Statistical Office DEMOGRAPHIC YEARBOOK 1951. New York, 1951. Table 28, pp. 512–513.

[4] Kiser, Clyde V.: The Demographic Position of Egypt. The Milbank Memorial Fund *Quarterly,* October, 1944, XXII, No. 4, pp. 383–408.

[5] Sindbis Health Center, Egypt. Annual Report for 1951 by Dr. J. M. Weir to The Rockefeller Foundation. Unpublished data.

clusions as to the net fertility of the women in this particular rural area of Iran. It is preferable, under the circumstances, to postpone calculation of a net fertility rate until such time as accurate statistics on survival are available in Iran itself.

Summary

1. Certain demographic data derived from a survey of 173 villages in a small rural area of Iran are discussed.

2. These data include an analysis of the population by age, sex, and marital status, as well as informants' reports on pregnancies, births, and infant deaths during the ten-year period prior to the survey.

3. Comparative data on both pregnancy and fertility rates are presented.

4. The findings are referable to the surveyed population during the period in question and not to Iran as a whole.

Acknowledgment

We wish to acknowledge the advice of Dr. John Murray, ex-Statistical Consultant to the Iranian Seven Year Plan Organization, in the planning of the original survey form, and the help of Dr. Clyde V. Kiser, of the Milbank Memorial Fund, and Dr. George J. Stolnitz, of the Office of Population Research at Princeton University, in the preparation of the manuscript.

SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY

XIX. FEAR OF PREGNANCY AND CHILDBIRTH IN RELATION TO FERTILITY-PLANNING STATUS AND FERTILITY[1]

NATHALIE SCHACTER AND CLYDE V. KISER

ONE of the hypotheses in the Indianapolis Study was "The greater the fear of pregnancy the higher the proportion of couples practicing contraception effectively and the smaller the planned families." It should be stated at the outset that in the present context "fear of pregnancy" is not to be interpreted as any general apprehension over the possibility of having an unwanted pregnancy but rather as fear of the physical consequences of pregnancy and childbirth such as fear of pain and suffering, fear of impairment to wife's health, and fear of death.

The rationale for including this hypothesis in the Study was not a belief that fear of pregnancy is a *major* factor affecting fertility. However, the possibility that fear of pregnancy and childbirth was one of the deterrents to fertility of modern urban women had been mentioned recurrently in the literature and it seemed advisable to secure data on this subject.

Although the writers know of no previous study devoted exclusively to the relation of fear of pregnancy to fertility, some data along these lines are available from previous studies. Dickenson and Beam reported the occurrence of fear of pregnancy in about 300 of the 1,000 couples in their study A THOUSAND MARRIAGES. They afford no information on the intensity of the fear, and some of the cases of fear on the part

[1] This is the nineteenth of a series of reports on a study conducted by the Committee on Social and Psychological Factors Affecting Fertility, sponsored by the Milbank Memorial Fund with grants from the Carnegie Corporation of New York. The Committee consists of Lowell J. Reed, Chairman; Daniel Katz; E. Lowell Kelly; Clyde V. Kiser; Frank Lorimer; Frank W. Notestein; Frederick Osborn; S. A. Switzer; Warren S. Thompson; and P. K. Whelpton.

The present report is based largely upon a previous treatment of the data in Schacter, Nathalie.: Fertility in Relation to Fertility Planning and Fear of Pregnancy. Master's Thesis, Department of Sociology, Faculty of Political Science, Columbia University, 1953, 70 pp. (unpublished).

of the husband, at least, appear to be simply apprehension over the possibility of an unwanted pregnancy. Thus the husband "dreads not only the risk to the wife, but the economic risk; and probably also the risk to love in the presence of increasing burdens." The authors further state, however, that most of the fears are "the great nameless fears of danger, of labor, and death."[2] The study contains no direct analysis of the relation of fear to fertility but an underlying thesis of the book is that poor sex adjustment is a deterrent to fertility and that fear or dread of pregnancy is a factor in poor sex adjustment.

In his study of factors affecting fertility in a selected professional group (United States Army Air Corps officers), Flanagan found that over 10 per cent of the wives who never had children and were not expecting any, reported that they had been "afraid of childbirth." More than a quarter of the officers in the total study stated that consideration of the wife's health had been one of the factors preventing them from planning additional children. According to Flanagan's data, "29 per cent of the officers and 26 per cent of the wives report that they would plan to have a larger family if 'painless and safe childbirth were assured by advances in medical science.' In response to another question . . . 69 per cent of the officers and 46 per cent of the wives report that they would plan to have a smaller family if 'The wife could have children only by Caesarian operation.'"[3] As a general conclusion, Flanagan states that the "husband's consideration for the wife's health and the wife's fear of childbirth both play a definite but relatively minor part in determining size of family."[4]

The Data. The data from the Indianapolis Study[5] on the

[2] Dickenson, R. L. and Beam, L.: A THOUSAND MARRIAGES: A MEDICAL STUDY OF SEX ADJUSTMENT. Baltimore, The Williams and Wilkins Company, 1931, p. 247.

[3] Flanagan, John C.: A Study of Factors Determining Family Size in a Selected Professional Group. *Genetic Psychology Monographs*, 1942, XXV, pp. 38–39.

[4] *Ibid.*, p. 61.

[5] The general purpose, scope, and methods of the Study have been described

(Continued on page 168)

presence and intensity of fear of pregnancy and childbirth are based upon replies of wives and husbands to several questions. The pregnancy schedule contained provision for recording the wife's statement regarding degree of fear of each pregnancy or childbirth. The five possible replies for each pregnancy were very much, much, some, little, and very little. These data for specific pregnancies were coded and they will be presented in a later section of this report. An average rating on fear of all pregnancies was also computed for each wife. These averages range from 1 (high fear) to 5 (low fear) since the five possible replies were scored 1–5 in the order named. Fear of pregnancy was also recorded for the never-pregnant women. The single ratings for these women (and the single ratings for women having only one pregnancy) were considered as "average ratings."

The remaining questions on fear of pregnancy and childbirth appeared in the self-administered multiple-choice questionnaires.

The questions for the wives were:

> How much has the fear or dread of pregnancy and childbirth discouraged you and your husband from having (more) children?
>
> How much risk to your health do you think you would run in having a (another) child?
>
> How much risk to your health does your husband think you would run in having a (another) child?

in detail in previous articles. The Study was conducted in Indianapolis in 1941 and the data for the present analysis relate to an adjusted sample of 1,444 "relatively fecund" couples with the following characteristics: husband and wife native white, both Protestant, both finished at least the eighth grade, married during 1927–1929, neither previously married, husband under 40 and wife under 30 at marriage, and eight or more years spent in a city of 25,000 population or over since marriage. Couples with these characteristics were located by means of a preliminary Household Survey of virtually all white households in Indianapolis.

For purposes of the Study, all couples with four or more live births were classified as "relatively fecund" regardless of other circumstances. Couples with 0–3 live births were classified as "relatively fecund" unless they knew or had good reason for believing that conception was physiologically impossible during a period of at least 24 or 36 consecutive months since marriage (24 for never-pregnant couples, 36 for others). Failure to conceive when contraception was not practiced "always" or "usually" during periods of above durations was considered "good reason" for such belief. Couples not classified as "relatively fecund" were considered "relatively sterile."

The questions for the husbands were:

How much has the fear or dread of pregnancy and childbirth discouraged you and your wife from having (more) children?

How much risk to her health do you think your wife would run in having a (another) child?

How much risk to her health does your wife think she would run in having a (another) child?

How much did you dread childbirth for your wife before your first child was born? (Not asked of childless husbands.)

Table 1. Distribution of wives or husbands in the Indianapolis Study according to three criteria of fear of pregnancy and childbirth.

Criterion of Fear	Number		Per Cent	
	Wife	Husband	Wife	Husband
Extent Couple Was Discouraged From Having (More) Children By Fear or Dread of Pregnancy and Childbirth				
Replies: (Total)	1,444	1,444	100.0	100.0
Very Much	95	71	6.6	4.9
Much	87	100	6.0	7.0
Some	243	261	16.9	18.2
Little	228	305	15.8	21.2
Very Little or Not at All	789	700	54.7	48.7
No Reply	2	7		
Average Rating Wife's Fear of Pregnancy				
Ratings: (Total)	1,444		100.0	
1–1.9 (High Fear)	60		4.2	
2–2.9	62		4.3	
3–3.9	203		14.1	
4–4.9	328		22.8	
5 (Low Fear)	786		54.6	
Unknown	5			
Husband's Dread of Childbirth for Wife Before First Child Was Born				
Replies: (Total)		1,309		100.0
Very Much		413		31.6
Much		148		11.3
Some		389		29.7
Little		122		9.3
Very Little		237		18.1

Prevalence of Fear of Pregnancy. The distributions of replies to the above questions, given in Tables 1 and 2, suggest the relative infrequency of strong fear of pregnancy among the group as a whole. Only 13 per cent of the wives and 12 per cent of the husbands stated that fear or dread of pregnancy and childbirth had discouraged them "very much" or "much" from having children or more children. Over half of the wives (55 per cent) and nearly half (49 per cent) of the husbands replied "very little or not at all." Only 8 per cent of the wives exhibited average ratings on fear of pregnancy equivalent to the "very much" or "much" levels and over half (55 per cent) fell into the category of lowest fear. This last mentioned category is necessarily restricted to women with no rating except "very little" for any pregnancy.

Likewise, only 11 per cent of the wives and 15.5 per cent of the husbands thought the risk to the wife's health in having a (another) child was "very much more" or "much more" than

Table 2. Percentage distribution by risk to wife's health in having another child, as determined by wife's opinion, husband's opinion, wife's rating of husband's opinion, and husband's rating of wife's opinion.

Risk to Wife's Health in Having A (Another) Child	Wife's Opinion	Husband's Opinion	Wife's Rating of Husband's Opinion	Husband's Rating of Wife's Opinion
Total Number of Replies (Percentage Bases)	1,444	1,444	1,441[a]	1,440[a]
Replies (Per Cent)	100.0	100.0	100.0	99.9
Very Much More Than Most Women	6.3	8.6	5.3	7.8
Much More Than Most Women	4.8	6.9	6.8	6.3
Somewhat More Than Most Women	17.6	20.6	20.5	15.2
About Average	61.2	52.1	58.2	56.1
Somewhat Less Than Most Women	3.4	8.1	4.5	7.6
Much Less Than Most Women	6.7	3.7	4.7	6.9

[a] Three and four unknowns in the last two columns are not included in the percentage bases.

that incurred by most women. Over half of the replies to this question were "about average." Only 9–15 per cent were to the effect that the wife's risk to her health was "somewhat" or "much" *less* than that incurred by most women.

It will be noted that about 43 per cent of the fathers stated that before the first child was born they had dreaded childbirth for the wife "very much" or "much." It is recognized that the movies, the comics, the novel, and the radio all picture the young husband as nervously pacing the floor and anxiously awaiting news of his wife's condition after delivery. This is perhaps an "expected" reaction on the part of the young husband. At all events, it seems likely that the husband's dread of his wife's first childbirth may be too frequently experienced to afford a good index of fear of pregnancy.

Interrelation of Replies. In view of the somewhat different types of distribution of replies to the several questions, it is not surprising to find rather low inter-correlation of some of the items. Perhaps because of reasons given above there is very little relation of husband's replies on "dread of childbirth for wife before first child was born" to husband's replies on "extent discouraged" ($r = +.12$) or "risk to wife's health" ($r = +.06$). However, a relatively high correlation is found between "average of wife's ratings on fear of pregnancy" and wife's reply on "extent discouraged" ($r = +.45$). The highest coefficient ($r = +.53$) among those presented below[6] is that between reply of wife and reply of husband to the question regarding "risk to wife's health." The percentage of couples

[6] Some Pearsonian coefficients of correlation are presented below (all are positive).

Question and Spouse Considered	Extent Discouraged		Risk to Wife's Health	
	Wife's Reply	Husband's Reply	Wife's Reply	Husband's Reply
Extent Discouraged (W)		.21	.27	
Risk to Wife's Health (H)		.30	.53	
Average of Ratings on Fear (W)	.45		.13	
Dread of First Childbirth (H)		.12		.06

Table 3. Fertility planning status by statement of wife and husband concerning the extent to which the couple was discouraged from having (more) children because of fear of pregnancy and childbirth. Data for all couples and by number of live births experienced.

Extent Discouraged From Having (More) Children by Fear of Pregnancy and Childbirth	Per Cent Distribution by Fertility-Planning Status									
	By Statement of Wife					By Statement of Husband				
	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples										
Very Much	100	29.5	15.8	18.9	35.8	100	32.4	7.0	28.2	32.4
Much	100	25.3	3.4	34.5	36.8	100	34.0	19.0	21.0	26.0
Some	100	24.7	11.1	29.6	34.6	100	25.7	14.2	30.7	29.5
Little	100	32.5	7.9	30.3	29.4	100	26.2	13.4	32.1	28.2
Very Little	100	27.8	18.0	33.3	20.9	100	27.9	14.7	33.1	24.3
Couples With One Live Birth										
Very Much and Much	100	35.7	0.0	42.9	21.4	100	43.5	0.0	43.5	13.0
Some	100	34.0	3.8	43.4	18.9	100	39.7	4.4	42.6	13.2
Little	100	48.5	5.9	30.9	14.7	100	33.8	5.4	43.2	17.6
Very Little	100	41.0	5.3	42.0	11.7	100	42.3	5.1	37.7	14.9
Couples With Two Live Births										
Very Much and Much	100	9.1	20.5	36.4	34.1	100	14.6	31.3	27.1	27.1
Some	100	15.5	17.5	39.8	27.2	100	9.6	27.7	33.7	28.9
Little	100	19.7	13.2	43.4	23.7	100	19.8	19.8	38.2	22.1
Very Little	100	24.4	28.3	34.6	12.7	100	25.2	22.6	39.4	12.8
Couples With Three Live Births										
Very Much and Much	100	10.8	18.9	18.9	51.4	100	5.3	21.1	26.3	47.4
Some	100	3.3	10.0	13.3	73.3	100	0.0	13.0	32.6	54.3
Little	100	5.7	5.7	28.6	60.0	100	9.1	14.5	16.4	60.0
Very Little	100	3.8	22.0	31.8	42.4	100	5.3	20.2	29.8	44.7
Couples With Four or More Live Births										
Very Much and Much	100	0.0	9.1	4.5	86.4	100	0.0	12.0	8.0	80.0
Some	100	3.0	12.1	12.1	72.7	100	3.0	15.2	24.2	57.6
Little	100	3.8	7.7	19.2	69.2	100	3.6	9.0	25.2	62.2
Very Little	100	3.4	11.2	32.6	52.8					

with wife and husband giving identical replies was 37 for the question on "extent discouraged" and 53 for the question on "risk to wife's health." There were five possible replies to the former question and six to the latter.

The Planning of Fertility in Relation to Fear of Pregnancy

As already noted, the first part of the hypothesis considered states: "The greater the fear of pregnancy the higher the proportion of couples practicing contraception effectively. . . ." As in previous reports, couples are regarded as having practiced contraception effectively if they are classified either as "number and spacing of pregnancies planned" or as "number planned." The basic classification of the 1,444 "relatively fecund" couples by fertility-planning status has been described in previous reports. It is based upon the detailed pregnancy and contraceptive histories, including data on outcome of pregnancies and attitudes toward each pregnancy. The four broad categories used in the Study, in descending degree of success in planning family size, are: number and spacing of pregnancies planned, number planned, quasi-planned, and excess fertility.[7]

Extent Fear of Pregnancy Discouraged Couple from Having (More) Children. As indicated in Table 3 and the upper half

[7] The four categories may be briefly described as follows:

Number and Spacing of Pregnancies Planned. The 403 couples in this group exhibit the most complete planning of fertility in that they had no pregnancies that were not deliberately planned by stopping contraception in order to conceive. The group consists of two major subdivisions: (a) 121 couples practicing contraception regularly and continuously and having no pregnancy, and (b) 282 couples whose every pregnancy was deliberately planned by interrupting contraception in order to conceive.

Number Planned. This group of 205 couples consists mainly of those whose *last* pregnancy was deliberately planned by stopping contraception in order to conceive but who had one or more previous pregnancies under other circumstances. Because of this, the couples are regarded as having planned the number but not the spacing of their pregnancies.

Quasi-Planned. This group includes 454 couples who did not deliberately plan the last pregnancy in the manner described above but who either wanted the last pregnancy or wanted another pregnancy.

Excess Fertility. This group is composed of 382 couples classified as least successful in planning size of family because one or more pregnancies had occurred after the last that was wanted.

of Figure 1, there is no striking relationship between fertility-planning status and either wife's opinion or husband's opinion on extent to which fear or dread of pregnancy and childbirth had discouraged the couple from having children or more children.[8] The relationship that does exist runs counter to the hypothesis. For instance, except for the group labeled "very much" under "wife's opinion," the proportion of "planned families" increases and the proportion of "excess fertility" couples decreases with *lowering* of discouragement from having children or more children by fear of pregnancy. This is true despite the fact that childless couples are included in the Figure 1 data and childless couples are by definition restricted almost exclusively to the "number and spacing planned" group and (as will be indicated in a later section) tend to exhibit relatively high fear of pregnancy by all measures available.

When fertile couples are considered by specific number of live births (Table 3), the tendency for the proportion of excess fertility couples to increase with degree of discouragement is found to be rather strong. This type of relationship perhaps simply illustrates again that a given factor may be the result rather than the cause of fertility behavior. In this case it seems likely that strong discouragement from having more children because of fear is more nearly the result than the cause of failure to prevent unwanted pregnancies. This type of failure is the essential characteristic of "excess fertility" couples. (*See* footnote 7 above.)

Risk to Health Wife Would Run in Having a (Another) Child. This item was included in a previous report on the Indianapolis Study concerning health of wife in relation to fertility-planning status and fertility. In that article distribu-

[8] The chi square of the proportions of "number and spacing planned" couples, by extent discouraged from having (more) children by fear of pregnancy (replies of wives or husbands) indicates that the differences are *not* significant at the 5 per cent level (d.f. = 4).

The chi square of the proportions of "excess fertility" couples, by wife's reply to the question on "extent discouraged" indicates significant differences at the 1 per cent level (d.f. = 4). However, by husband's reply the differences are *not* significant at the 5 per cent level (d.f. = 4).

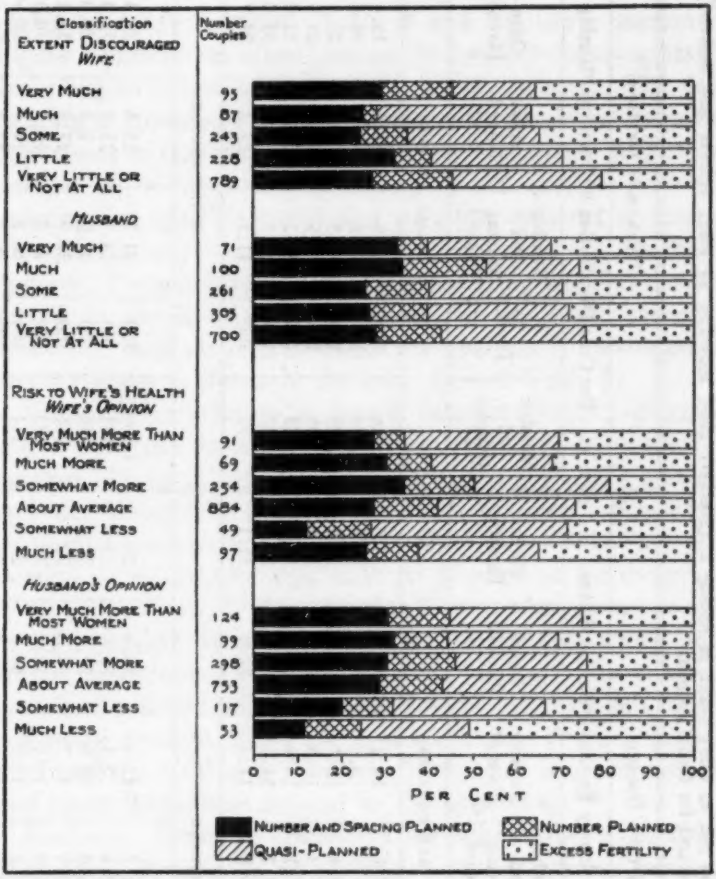


Fig. 1. Fertility-planning status by statement of the wife and husband regarding extent to which the couple was discouraged from having (more) children because of fear of pregnancy, and by risk to health wife would run in having a (another) child. (*See* Tables 3 and 4)

tions by fertility-planning status were shown by risk to wife's health in having a (another) child according to wife's opinion and husband's opinion (separately and jointly considered) and according to wife's rating of husband's opinion and husband's

Table 4. Fertility-planning status by risk to wife's health in having a (another) child according to wife's opinion and husband's opinion. Data presented for all couples and for fertile couples.

Risk to Wife's Health in Having a (Another) Child (Relative to "Most" Women)	Wife's Opinion						Husband's Opinion					
	Per Cent Distribution by Fertility-Planning Status						Per Cent Distribution by Fertility-Planning Status					
	Number of Couples	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Number of Couples	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
	ALL COUPLES						ALL COUPLES					
All Couples	1,444	100	27.9	14.2	31.4	26.5	1,444	100	27.9	14.2	31.4	26.5
Very Much More	91	100	27.5	6.6	35.2	30.8	124	100	30.6	13.7	30.6	25.0
Much More	69	100	30.4	10.1	27.5	31.9	99	100	32.3	12.1	25.3	30.3
Somewhat More	254	100	33.9	16.5	30.7	18.9	298	100	30.5	15.4	29.9	24.2
About Average	884	100	27.1	14.9	31.2	26.7	753	100	28.2	14.6	32.9	24.3
Somewhat Less	49	100	12.2	14.3	44.9	28.6	117	100	20.5	11.1	35.0	33.3
Much Less	97	100	25.8	11.3	27.8	35.1	53	100	11.3	13.2	24.5	50.9
	FERTILE COUPLES						FERTILE COUPLES					
All Fertile Couples	1,309	100	21.2	15.4	34.4	29.1	1,309	100	21.2	15.4	34.4	29.1
Very Much More	85	100	22.4	7.1	37.6	32.9	111	100	24.3	15.3	32.4	27.9
Much More	64	100	25.0	10.9	29.7	34.4	84	100	25.0	9.5	29.8	35.7
Somewhat More	239	100	30.5	16.7	32.6	20.1	266	100	22.9	17.3	33.1	26.7
About Average	781	100	18.4	16.6	34.8	30.1	685	100	21.2	16.1	36.1	26.7
Somewhat Less	47	100	8.5	14.9	46.8	29.8	111	100	16.2	11.7	36.9	35.1
Much Less	93	100	22.6	11.8	29.0	36.6	52	100	9.6	13.5	25.0	51.9

rating of wife's opinion.[9] Table 4 and the lower section of Figure 1 present the classifications by fertility-planning status according to wife's opinion and husband's opinion. The data relating to husband's opinion are partially consistent with the hypothesis in that there is a fairly regular increase in the proportion of "number and spacing planned" families with increasing risk to wife's health that would be incurred by having a pregnancy or another pregnancy according to the husband's opinion. These differences are not statistically significant when tested on the basis of numbers in the uninflated sample.[10] However, they do persist when the analysis is restricted to fertile couples as shown in the lower part of Table 4.

Virtually no relation is found between fertility-planning status and "risk to wife's health" as determined by the wife's opinion (Figure 1), the wife's rating of the husband's opinion, and the husband's rating of the wife's opinion.[11] Regarding the joint classification Herrera and Kiser stated that "the proportion of 'planned families' is about 44 per cent for the group in which both wife and husband indicated above-average risk to wife's health. It is 43 per cent for the group in which both stated 'about average' and 23 per cent for the group in which both husband and wife indicated that the risk to wife's health was below average. However, whereas the first two percentages are based upon 297 and 575 cases, the last one is based upon 53 and hence lends little support to the hypothesis."[12]

Husband's Dread of Childbirth for Wife Before First Child Was Born. Practically no relation is found between fertility-planning status and replies of fathers to the question "How

[9] Herrera, Lee and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. XIII. Fertility in Relation to Fertility Planning and Health of Wife, Husband, and Children. The Milbank Memorial Fund *Quarterly*, July, 1951, XXIX, No. 3, pp. 346–347 (Study Series, Vol. III, pp. 590–591).

[10] The chi square of the proportions of "number and spacing planned" couples by wife's or husband's opinion to risk to wife's health in having another child indicates that the differences are not significant at the 5 per cent level (d.f. = 5). The same holds true with reference to proportions of "excess fertility" couples.

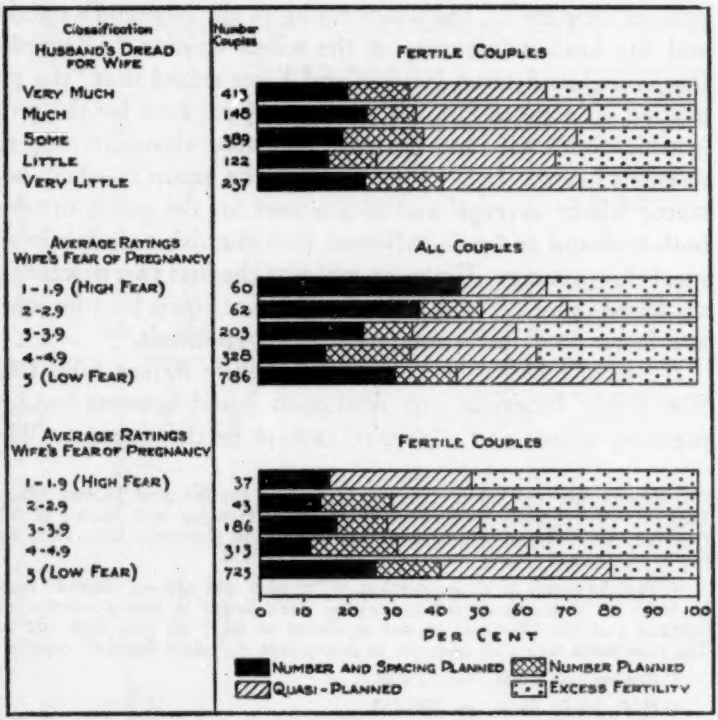
[11] Herrera and Kiser, *ibid.*, Table 7.

[12] *Ibid.*, Study Series, pp. 589–592.

much did you dread childbirth for your wife before your first child was born?" (*See* Figure 2 and Table 5.) That the replies to this question had little relation to replies to other questions has already been noted. It looks as if dread of wife's first childbirth on the part of the young husbands is too frequent to provide indication of actual fear of pregnancy. For these reasons it is perhaps not surprising that no relationship is found between responses to the question and fertility-planning status.

Average of Ratings on Wife's Fear of Pregnancy. As already

Fig. 2. Fertility-planning status by husband's dread of childbirth for wife before first child was born and by average of ratings on wife's fear of pregnancy. (*See* Table 5)



indicated, all wives with one or more pregnancies were asked with reference to each pregnancy "Were you afraid of pregnancy and childbirth?" These data were collected as part of the detailed information on pregnancy histories. Women who were never pregnant were asked "Are you afraid of pregnancy and childbirth?"

With a rating of replies as follows: very much (1), much (2), some (3), little (4), and very little (5), averages of

Table 5. Fertility-planning status by husband's dread of childbirth for wife before first child was born and by average of ratings on wife's fear of pregnancy and childbirth.

Criterion of Fear	Number of Couples	Per Cent Distribution by Fertility-Planning Status				
		Total	Number and Spacing	Number Planned	Quasi-Planned	Excess Fertility
Husband's Dread of First Childbirth For Wife						
Fertile Couples, Total	1,309	100	21.2	15.4	34.4	29.1
Very Much	413	100	20.8	13.8	31.5	33.9
Much	148	100	25.0	11.5	39.2	24.3
Some	389	100	19.5	18.5	35.2	26.7
Little	122	100	16.4	10.7	41.0	32.0
Very Little	237	100	24.5	17.7	31.6	26.2
Average of Ratings on Wife's Fear of Pregnancy						
All Couples, Total	1,444[a]	100	27.9	14.2	31.4	26.5
1–1.9 (High Fear)	60	100	46.7	0.0	20.0	33.3
2–2.9	62	100	37.1	14.5	19.4	29.0
3–3.9	203	100	24.6	10.8	24.1	40.4
4–4.9	328	100	15.9	19.2	28.7	36.3
5 (Low Fear)	786	100	31.8	13.9	36.1	18.2
Fertile Couples, Total	1,309[a]	100	21.2	15.4	34.4	29.1
1–1.9 (High Fear)	37	100	16.2	0.0	32.4	51.4
2–2.9	43	100	14.0	16.3	27.9	41.9
3–3.9	186	100	17.7	11.8	26.3	44.1
4–4.9	313	100	11.8	20.1	30.0	38.0
5 (Low Fear)	725	100	26.9	14.8	38.6	19.7

[a] Includes five couples unknown as to average of wife's ratings on fear of pregnancy.

Fear of Specific Pregnancy	Number of Couples	Per Cent Distribution by Fertility-Planning Status: Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
ALL COUPLES—INCLUDING NEVER PREGNANT						
First Pregnancy						
Very Much and Much	115	100	43.5	4.3	21.7	30.4
Some	108	100	36.1	15.7	25.0	23.1
Little	145	100	22.8	15.2	35.9	26.2
Very Little	1,069	100	26.1	15.1	32.4	26.5
COUPLES EXPERIENCING SPECIFIED PREGNANCY						
First Pregnancy						
Very Much and Much	75	100	13.3	6.7	33.3	46.7
Some	92	100	25.0	18.5	29.3	27.2
Little	131	100	14.5	16.8	39.7	29.0
Very Little	1,018	100	22.4	15.8	34.0	27.8
Second Pregnancy						
Very Much and Much	118	100	8.5	18.6	33.1	39.8
Some	66	100	16.7	13.6	15.2	54.5
Little	148	100	12.8	15.5	31.8	39.9
Very Little	675	100	15.6	20.7	34.2	29.5
Third Pregnancy						
Very Much and Much	69	100	0.0	13.0	18.8	68.1
Some	34	100	11.8	8.8	20.6	58.8
Little	77	100	3.9	19.5	26.0	50.6
Very Little	331	100	6.6	16.9	26.6	49.8
Fourth and Later Pregnancies						
Very Much and Much	71	100	0.0	7.0	7.0	85.9
Some	31	100	0.0	9.7	12.9	77.4
Little	38	100	0.0	15.8	21.1	63.2
Very Little	287	100	2.8	8.7	24.4	64.1

Table 6. Fertility-planning status according to wife's fear of specified pregnancies.

ratings on all pregnancies were computed for each woman. As indicated in the middle section of Figure 2, when the total sample is considered, i.e., when the childless wives are included, the proportion of "number and spacing planned" couples and the proportion of all "planned families" decline rather sharply with lowering of fear according to the average ratings.[13] Only the group of lowest fear ratings fails to conform to this pattern. However, it is also apparent that the childless couples are almost solely responsible for the indication of a direct relation between "fear" and fertility-planning status. When the analysis is restricted to couples experiencing one or more live births, as in the lowest section of Figure 2, the direct relation of the above type disappears and there is even some suggestion of the reverse relation. With reference to extreme classes, at least, the proportion of "planned families" increases and the proportion of "excess fertility" couples decreases with lowering of average fear of pregnancies among couples experiencing one or more pregnancies.

Fear of Specific Pregnancies. Table 6 gives the distributions by fertility-planning status according to wife's fear of specific pregnancies. The top-most section relates to all couples including those with no pregnancy.[14] The remaining sections are restricted to couples experiencing pregnancies of given order.

The data for all couples partially support the hypothesis in

[13] For all couples the proportions of both "n. and s. p." and "excess fertility" couples differ significantly by fear ($P < .001$). For fertile couples the differences are not significant at the 5 per cent level.

[14] In the top section the wives with no pregnancies are included with those having one or more pregnancies under the assumption that the never-pregnant wife's fear of "a pregnancy" is equivalent to fear of a "first pregnancy." This consolidation is not entirely justified in view of the nature of the data. Wives with no pregnancy were asked about their *current* attitudes when they were asked "Are you afraid of pregnancy and childbirth?" Those with one or more pregnanices were asked about their *past* attitudes when they were asked with regard to each pregnancy experienced "*Were* you afraid of pregnancy and childbirth?" Thus in addition to the difference in time reference there is the fact that the replies of the women with pregnancies are *ex post facto* whereas the replies of the never-pregnant women are not. Nevertheless, since the never-pregnant couples are by definition "number and spacing planned" it is manifestly of interest to present the distributions by fertility-planning status according to fear of first pregnancy with and without the inclusion of the never-pregnant couples.

that there is a rather striking, although not complete, direct relation of fear of first pregnancy to proportion of couples classified as "number and spacing planned." Approximately 44 per cent of the wives stating that they feared the first pregnancy (or "a pregnancy" if never pregnant) "very much" or "much" are in "number and spacing planned" families. The comparable proportion is 23 per cent for wives replying "little" and 26 per cent for those replying "very little." However, even in the data for all couples the proportions of couples classified as "excess fertility" are not consistent with the hypothesis.

That the "never-pregnant" couples are responsible for the partial direct association of fertility-planning status and fear of first pregnancy is demonstrated by the disappearance of this type of relation when the analysis is restricted to couples actually having a first pregnancy.

Likewise, when fertility-planning status is considered in relation to wife's fear of second and succeeding pregnancies experienced, the relationships do not support the hypothesis. Instead there is again some tendency for the proportion of planned families to increase and the proportion of "excess fertility" couples to decrease with lowering of fear of these pregnancies.

In general, therefore, the hypothesis "The greater the fear of pregnancy, the higher the proportion of couples practicing contraception effectively" receives some support in the present Study but this support appears to be due entirely to the influence of never-pregnant couples. The fear of "a pregnancy" is relatively high among these couples and they are by definition restricted to the number and spacing planned group. Among couples with pregnancies, the relation of fertility-planning status to fear of pregnancy tends actually to run counter to that assumed in the hypothesis.[15]

[15] It is also of interest to note the distributions of all pregnancies to the women in the Study by the conditions of fear under which the conceptions occurred and by fertility-planning status of the couple. Of all pregnancies rated as to fear, about 10 per cent were feared "very much" or "much" and 71 per cent were feared "very

(Continued on page 183)

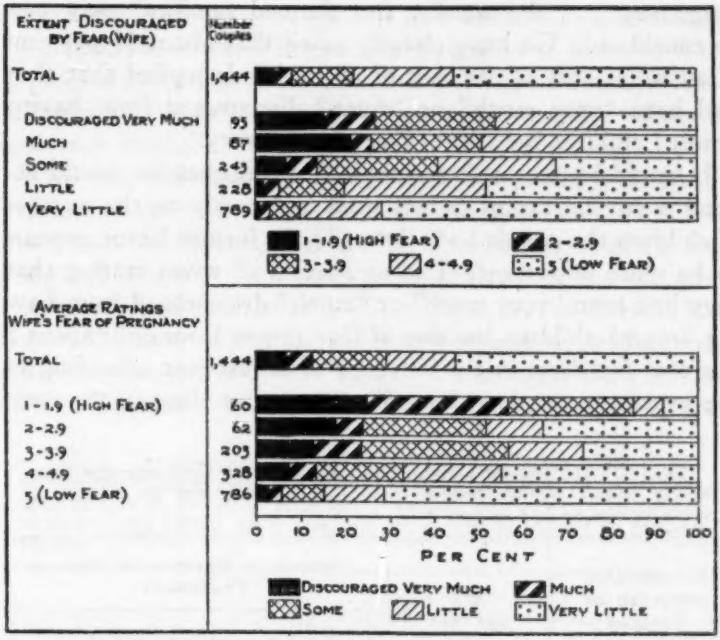


Fig. 3. The relation between wife's statement of discouragement from having (more) children because of fear of pregnancy to the average of wife's ratings on fear of pregnancy. (*See* Table 7)

Fear of Pregnancy in Relation to Fertility

The second part of the hypothesis "The greater the fear of

little." Among the "planned families" the corresponding percentages are 6 and 76. The complete data are as follows:

Fertility Planning Status of the Couple	Number Pregnancies	Per Cent Distribution by Fear of Pregnancy					
		Total	Very Much	Much	Some	Little	Very Little
All Couples	3,261	100	7.3	2.9	6.8	12.1	70.9
All Planned Families	983	100	3.1	3.2	7.1	10.9	75.8
Number and Spacing Planned	462	100	1.9	2.4	8.2	8.9	78.6
Number Planned	521	100	4.0	3.8	6.1	12.7	73.3
Quasi-Planned	992	100	6.3	2.0	4.8	12.8	74.1
Excess Fertility	1,286	100	11.4	3.3	8.2	12.4	64.6

pregnancy . . . the smaller the planned families" may now be considered. We have already noted that about 13 per cent of all wives and 12 per cent of all husbands replied that they had been "very much" or "much" discouraged from having (more) children because of fear of pregnancy.

It would be expected that replies to this question would depend partly on extent of fear itself and partly on the number of children the couple had. Actually the former factor appears to be more important. The proportion of wives stating that they had been "very much" or "much" discouraged from having (more) children because of fear ranges from only about 5 per cent for those in the category of lowest fear according to the average ratings to about 57 per cent for those in the cate-

Table 7. The relation between wife's statement of discouragement from having (more) children because of fear of pregnancy and the average of wife's ratings on fear of pregnancy.

Extent Discouraged by Fear of Pregnancy	All Couples		Average of Ratings of Fear of Pregnancy				
			1–1.9 (High)	2–2.9	3–3.9	4–4.9	5 (Low)
Number of Couples	1,442[a]		60	62	203	326	786
Per Cent							
Total	100		100	100	100	100	100
Very Much	6.6		25.0	17.7	12.8	7.1	2.5
Much	6.0		31.7	6.5	10.8	6.1	2.8
Some	16.9		28.3	27.4	33.0	19.9	9.8
Little	15.8		6.7	12.9	16.7	22.1	13.6
Very Little	54.7		8.3	35.5	26.6	44.8	71.2
	Number Couples	Per Cent					
All Couples	1,439[b]	100	4.2	4.3	14.1	22.8	54.6
Very Much	95	100	15.8	11.6	27.4	24.2	21.1
Much	87	100	21.8	4.6	25.3	23.0	25.3
Some	243	100	7.0	7.0	27.6	26.7	31.7
Little	225	100	1.8	3.6	15.1	32.0	47.6
Very Little	787	100	.6	2.8	6.9	18.6	71.2

[a] Excludes two couples unknown as to extent discouraged by fear of pregnancy.
[b] Excludes five couples unknown as to average of ratings on fear of pregnancy.

gory of strongest fear. (Figure 3 and Table 7.) Conversely, the proportion of wives in the two categories of strongest fear of pregnancy ranges from about 3 per cent for those "discouraged very little" to about 27 per cent for those "discouraged very much."

When the distributions of the replies are made within subdivisions of all couples and planned families by number of live births, the childless couples are seen to be the chief deviate group. (Table 8.) This is especially the case in the distributions by reply of the husband. Thus 17 per cent of the childless wives and 24 per cent of the childless husbands state that they had been "very much" or "much" discouraged from having children because of fear or dread of pregnancy and childbirth

Table 8. Distribution of couples by statement of wife and husband concerning the extent to which the couple was discouraged from having (more) children because of fear of pregnancy and childbirth, according to specific number of live births. Data presented for all couples and for all planned families.

Extent Couple Was Discouraged from Having (More) Children by Fear of Pregnancy and Childbirth	Number of Live Births									
	0	1	2	3	4+	0	1	2	3	4+
	By Statement of Wife					By Statement of Husband				
	ALL COUPLES									
Total Number (Percentage Bases)	135	365	538	234	170	135	363	536	234	169
Per Cent—Total	99.9	99.9	100.0	100.0	100.0	100.0	100.0	99.9	100.0	99.9
Very Much	7.4	7.1	5.0	9.8	5.3	11.1	5.5	2.6	3.8	7.7
Much	9.6	8.2	3.2	6.0	7.6	13.3	7.2	6.3	4.3	7.1
Some	17.8	14.5	19.1	12.8	19.4	23.0	18.7	15.5	19.7	19.5
Little	17.0	18.6	14.1	15.0	15.3	19.3	20.4	24.4	23.5	11.2
Very Little	48.1	51.5	58.6	56.4	52.4	33.3	48.2	51.1	48.7	54.4
	ALL PLANNED FAMILIES									
Total Number (Percentage Bases)	130	164	238	53	23	130	162	236	53	23
Per Cent—Total	100.0	100.0	100.0	100.0	99.9	100.0	99.9	99.9	99.9	100.0
Very Much	7.7	7.3	5.5	15.1	0.0	10.8	3.7	2.5	1.9	4.3
Much	9.2	4.9	0.0	5.7	8.7	13.1	8.6	6.8	7.5	8.7
Some	18.5	12.2	14.3	7.3	21.7	23.8	18.5	13.1	11.3	26.1
Little	17.7	22.6	10.5	7.5	13.0	19.2	17.9	22.0	24.5	8.7
Very Little	46.9	53.0	69.7	64.2	56.5	33.1	51.2	55.5	54.7	52.2

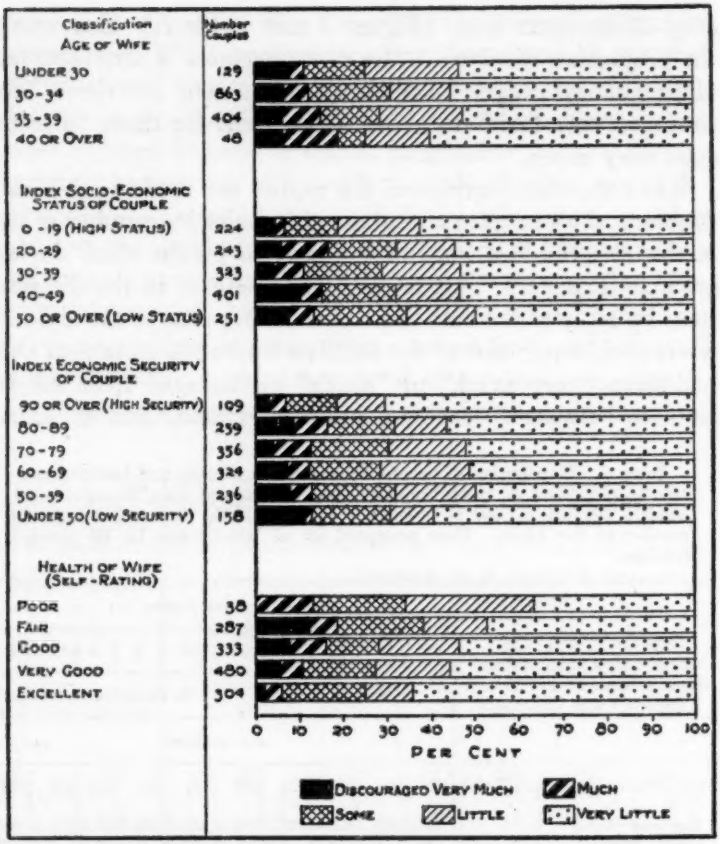


Fig. 4. Relation of wife's statement concerning extent of discouragement from having (more) children because of fear of pregnancy, to age of wife, index of socio-economic status of the couple, index of economic security of the couple, and health of wife. (*See* Table 9)

for the wife. For mothers or fathers of specific numbers of children the distributions do not differ in any systematic manner.

Closely related to data of the above type are the replies of wives and husbands as to which of ten listed reasons (including fear of pregnancy) were of first, second, and third importance in discouraging them from having children or more children. Thus among all wives about 6 per cent mentioned fear

of pregnancy and childbirth as the reason of first importance, 9 per cent as the reason of second importance, and 12 per cent as the reason of third importance. For the husbands the corresponding percentages are 6, 10 and 11.[16] Thus about 27 per

Table 9. Relation of wife's statement concerning extent of discouragement from having (more) children because of fear of pregnancy, to age of wife, index of socio economic status of the couple, index to economic security of the couple and health of wife.

Class	Number of Couples	Per Cent by Degree of Discouragement					
		Total	Very Much	Much	Some	Little	Very Little
All Couples	1,442[a]	100	6.6	6.0	16.9	15.8	54.7
Age of Wife							
Under 30	127[a]	100	7.9	3.1	14.2	21.3	53.5
30–34	863	100	6.5	5.7	18.7	13.4	55.7
35–39	404	100	6.4	8.4	13.6	19.3	52.2
40 or Over	48	100	6.3	0.0	18.8	14.6	60.4
Index of Socio Economic Status							
0–19 (High)	224	100	4.5	1.8	12.1	18.8	62.9
20–29	243	100	5.8	10.7	15.6	13.2	54.7
30–39	323	100	4.0	6.8	18.0	17.6	53.6
40–49	401[a]	100	10.0	5.0	16.7	14.5	53.9
50 or More (Low)	251	100	7.2	6.0	21.1	15.5	50.2
Index of Economic Security							
Under 50 (Low)	158	100	10.8	1.9	17.7	10.1	59.5
50–59	236	100	7.2	5.5	19.1	18.2	50.0
60–69	324	100	6.8	5.2	16.4	20.1	51.5
70–79	356	100	3.9	8.4	18.0	17.4	52.2
80–89	259	100	8.5	7.7	15.4	11.6	56.8
90 or Over (High)	109	100	2.8	3.7	11.9	11.0	70.6
Health of Wife							
Poor	38	100	0.0	13.2	21.1	28.9	36.8
Fair	287	100	12.2	6.6	19.5	14.3	47.4
Good	333	100	7.8	8.4	12.0	18.6	53.2
Very Good	480[a]	100	5.6	5.0	16.9	17.1	55.4
Excellent	304	100	2.3	3.6	19.1	10.5	64.5

[a] Excludes two couples unknown as to extent discouraged by fear of pregnancy.

[16] In addition to the 6 per cent of the wives and husbands listing "fear or dread of pregnancy and childbirth" as the reason of first importance, 17 per cent of the wives and 20 per cent of the husbands listed "poor health of the wife" as the most important reason. *See* Herrera and Kiser, *op. cit.* (Vol. III, p. 593.)

cent of the wives and husbands mention "fear or dread of pregnancy and childbirth" as the reason of first, second, or third importance in their being discouraged from having children or more children.

The replies of the wives to the question on "extent of discouragement from having (more) children because of fear or dread of pregnancy and childbirth" are shown in relation to certain characteristics of all wives or couples in Figure 4 and Table 9. It will be noted that degree of discouragement is to a slight extent directly related with age of the wife.[17] The replies of wives on discouragement appear to be related very little to rating of the couples on either index of economic security or index of socio-economic status. The slight relation that does exist is in each instance that of discouragement being associated with low economic security and low socio-economic status. As expected, the degree of discouragement from having (more) children because of fear of pregnancy is inversely related to the general health status of the wife.

In Figure 5 and Table 10, distributions by wife's statement on "extent discouraged" are shown according to wife's "persistent" experience with respect to complications of pregnancy, complications of the puerperium, and ease of birth. As indicated, the labels used in the stub of Table 10 are only approximate since they are based upon averages. However, these averages were computed for each of three 4–5 year periods of married life and the categories are restricted to women exhibiting no substantial variation in average rating by period of married life.[18]

[17] The concentration of the wives within a rather narrow age group results from sampling procedures and does not permit adequate analysis of the factor of age.

[18] The pregnancy history schedules contained provisions for recording the wife's rating of each pregnancy, puerperium, and birth in terms of the labels listed in the stub of Table 9. In the order named the five possible ratings in each case were coded 1-3-5-7-9. Averages of ratings on pregnancies experienced during each of three periods of married life were computed and the "pattern of average ratings by period" was coded. The categories listed in Table 10 do not include wives with substantial changes in average ratings from one period to the next. Since all couples had been married 12–15 years, the three periods of married life were of 4–5 years'

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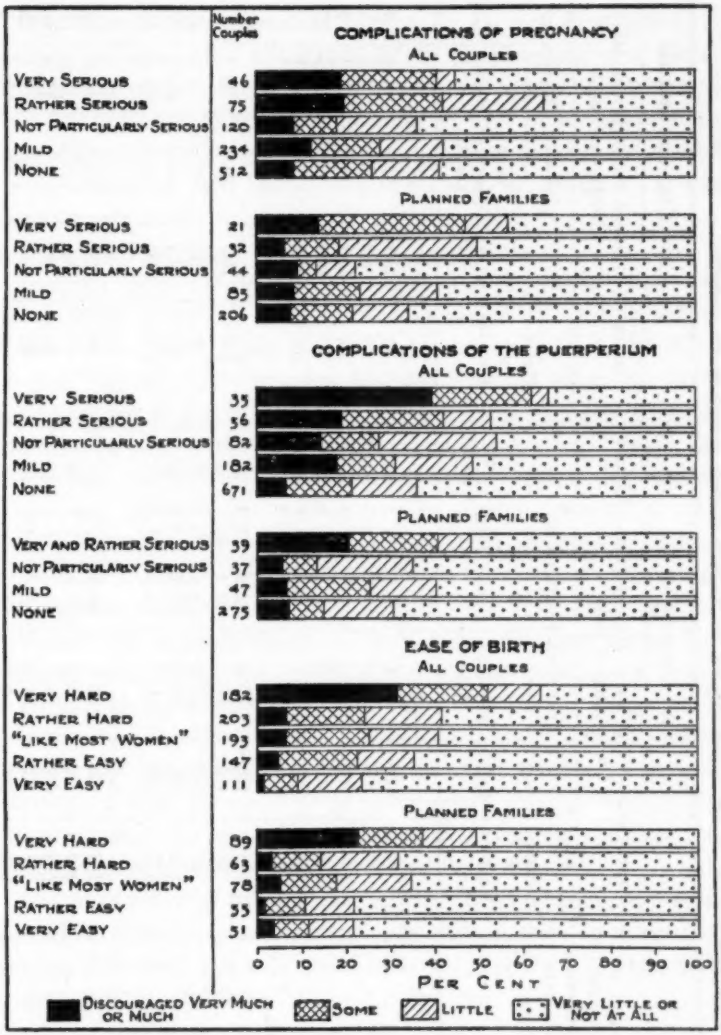

Fig. 5. Relation of wife's statement on extent to which the couple had been discouraged from having (more) children because of fear of pregnancy to persistent average ratings on complications of pregnancy, complications of the puerperium, and ease of birth. Data given for all couples and for planned families qualifying for inclusion. (*See* Table 10)

Table 10. Percentage distributions by wife's statement on extent to which the couple had been discouraged from having (more) children because of fear of pregnancy, according to persistent average ratings on complications of pregnancy, complications of the puerperium, and ease of birth. Data given for all couples and for all planned families qualifying for inclusion.[1]

Approximate Equivalent of Persistent Average Ratings Through Periods of Married Life in Which Pregnancies or Births Occurred	All Couples						All Planned Families					
	Extent Discouraged From Having More Children Because of Fear						Extent Discouraged From Having More Children Because of Fear					
	Number of Couples	Per Cent Distribution					Number of Couples	Per Cent Distribution				
		Total	Very Much or Much	Some	Little	Very Little		Total	Very Much or Much	Some	Little	Very Little
Complications of Pregnancy												
Very Serious	46	100	19.6	21.7	4.3	54.3	21	100	14.3	33.3	9.5	42.9
Rather Serious	75	100	20.0	22.7	22.7	34.7	32	100	6.3	12.5	31.3	50.0
Not Particularly Serious	120	100	8.3	10.0	18.3	63.3	44	100	9.1	4.5	9.1	77.3
Mild	234	100	12.4	15.8	14.5	57.3	85	100	8.2	15.3	17.6	58.8
None	512	100	8.6	17.8	15.4	58.2	206	100	7.8	14.1	12.6	65.5
Complications of the Puerperium												
Very Serious	35	100	40.0	22.9	2.9	34.3	39	100	20.5	20.5	7.7	51.3
Rather Serious	56	100	19.6	23.2	10.7	46.4						
Not Particularly Serious	82	100	14.6	13.4	26.8	45.1	37	100	5.4	8.1	21.6	64.9
Mild	182	100	18.1	13.7	17.6	50.5	47	100	6.4	19.1	14.9	59.6
None	671	100	6.7	15.2	14.8	63.3	275	100	6.9	8.0	16.0	69.1
Ease of Birth												
Very Hard	182	100	31.9	20.3	12.1	35.7	89	100	22.5	14.6	12.4	50.6
Rather Hard	203	100	6.9	17.2	17.7	58.1	63	100	3.2	11.1	17.5	68.3
Like Most Women	193	100	6.7	18.7	15.5	59.1	78	100	5.1	12.8	16.7	65.4
Rather Easy	147	100	4.8	17.7	12.9	64.6	55	100	1.8	9.1	10.9	78.2
Very Easy	111	100	1.8	7.2	14.4	76.6	51	100	3.9	7.8	9.8	78.4

[1] *See* text for further explanation of the categories.

Two points are evident in Figure 5. In the first place, if fertility-planning status is disregarded, the proportion of wives stating that they had been "very much" or "much" discouraged from having (more) children because of fear of pregnancy increases sharply with increasing complications of pregnancy and the puerperium and increasing difficulty of birth. In the second place, this type of relationship is much less evident for the "planned families" than for "all couples."

Fertility rates by fertility-planning status and by the several specific measures of fear of pregnancy are presented in Figures 6–9. With three of the four measures used, the data for the "number and spacing planned" group afford at least some support of the hypothesis. Thus within this group fertility rates tend to increase with lowering of extent to which the couple was discouraged from having more children by fear of pregnancy (Figure 6); with lowering of the amount of risk (relative to that of most women) the wife would run in having a (another) child (Figure 7); and with lowering of wife's fear of pregnancy and childbirth (Figure 8). The data for the "number and spacing planned" group fail to support the hypothesis only when the criterion of fear is "husband's dread of childbirth for wife before first child was born" (Figure 9).

In none of the data do the "number planned" couples alone support the hypothesis. However, in most cases the inverse relation of fear to fertility is sufficiently strong within the "number and spacing planned" group to persist within the total group of planned families. (See Appendix I.)

The next point of importance is that the strong inverse relation of fertility to fear of pregnancy within the "number and spacing planned" group accrues in large part from differentials in proportions childless.[19]

duration. In terms of codes the categories are:

(1) Average rating of all three periods 1 or 1–3
(3) Average rating of all three periods 3 or 3–5
(5) Average rating of all three periods 5 or 5–7
(7) Average rating of all three periods 7 or 7–9
(9) Average rating of all three periods 9

[19] It will be recalled that "relatively sterile" couples were eliminated from

(Continued on page 192)

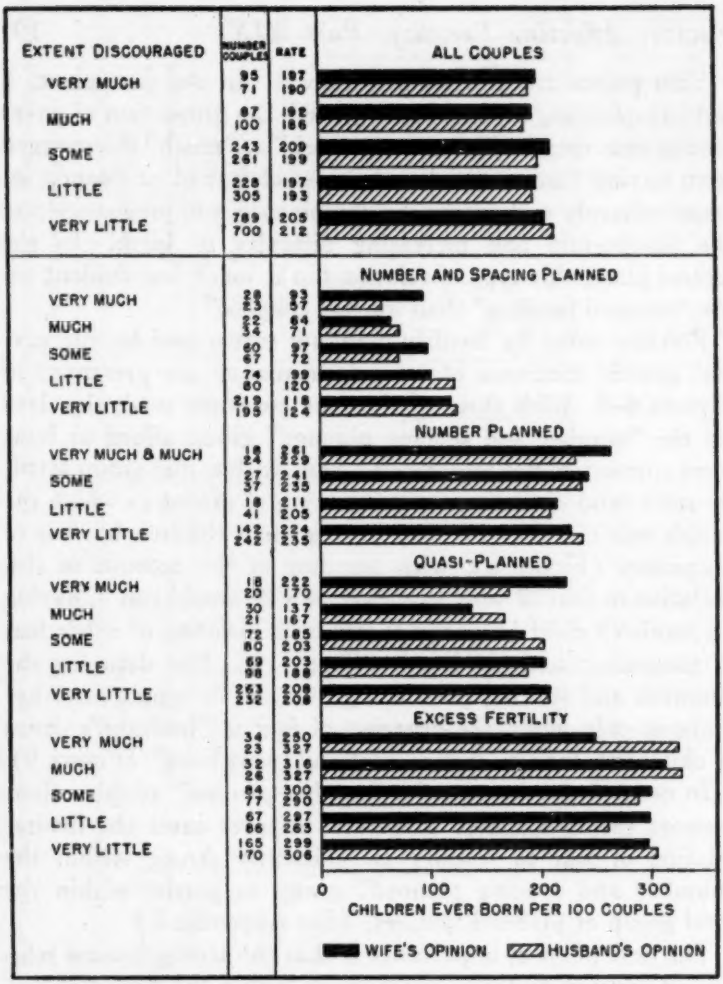

Fig. 6. Number of children ever born per 100 couples, by fertility-planning status and by statement of wife and husband regarding extent to which the couple was discouraged from having (more) children because of fear of pregnancy.

the Intensive Study and that "never pregnant" couples were classified as "relatively fecund" only if they had practiced contraception regularly and continuously since marriage. By definition, these "never pregnant" women were assigned exclusively to the "number and spacing planned" group. Hence the childless couples in the Study are in the main voluntarily childless and are restricted mainly to the "number and spacing planned" group. The few exceptions in each instance are couples having no live birth but one or more pregnancies terminating in stillbirths or unintentional abortions.

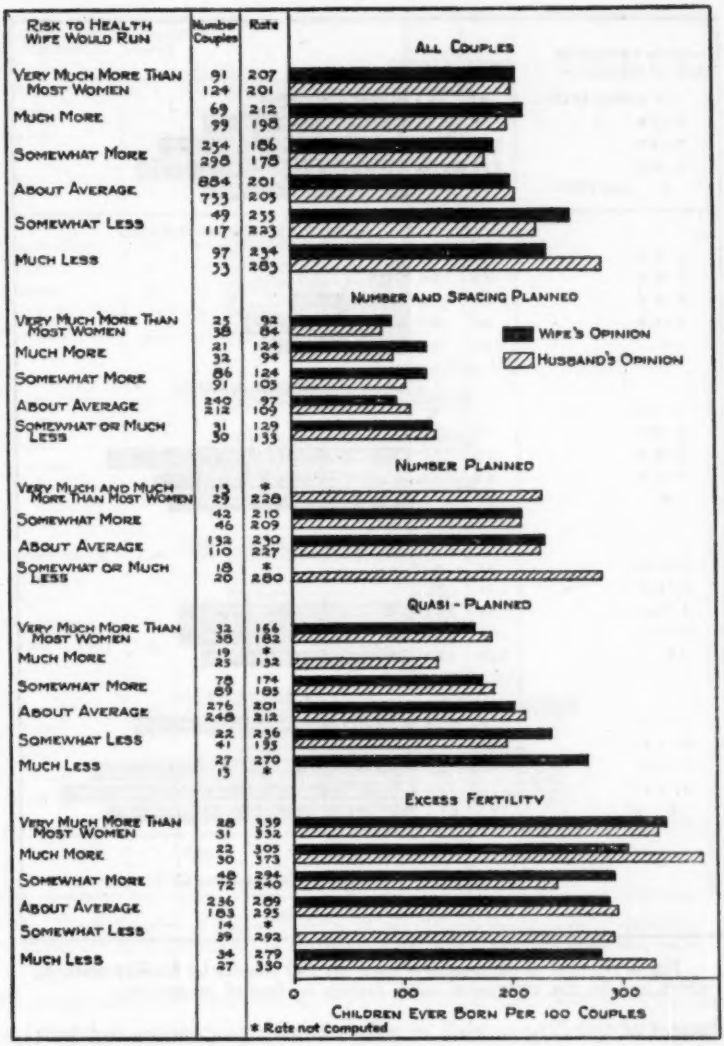

Fig. 7. Number of children ever born per 100 couples, by fertility-planning status and by opinion of the wife and husband as to the risk to health the wife would run in having a (another) child.

When the analysis is restricted to fertile couples, the inverse

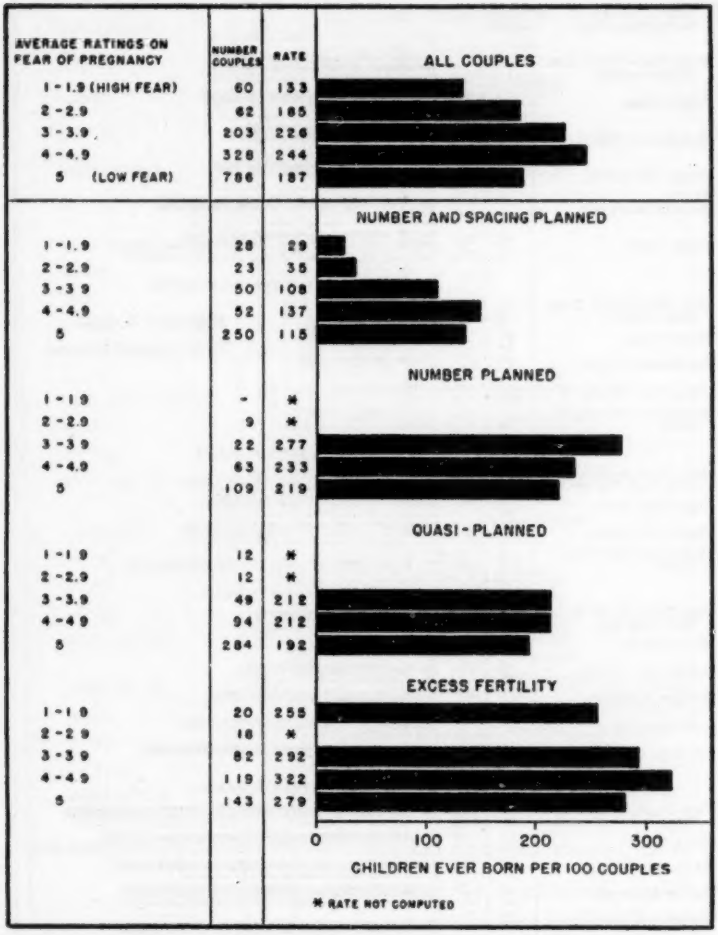

Fig. 8. Number of children ever born per 100 couples by fertility-planning status and by the average of wife's ratings on fear of pregnancy.

relation of fertility to risk to wife's health (as estimated by the wife or husband) persists to some extent with the "number and spacing planned" group and among the total group of "planned families." However, the inverse relation of fertility to wife's fear of pregnancy (as determined by average of ratings for

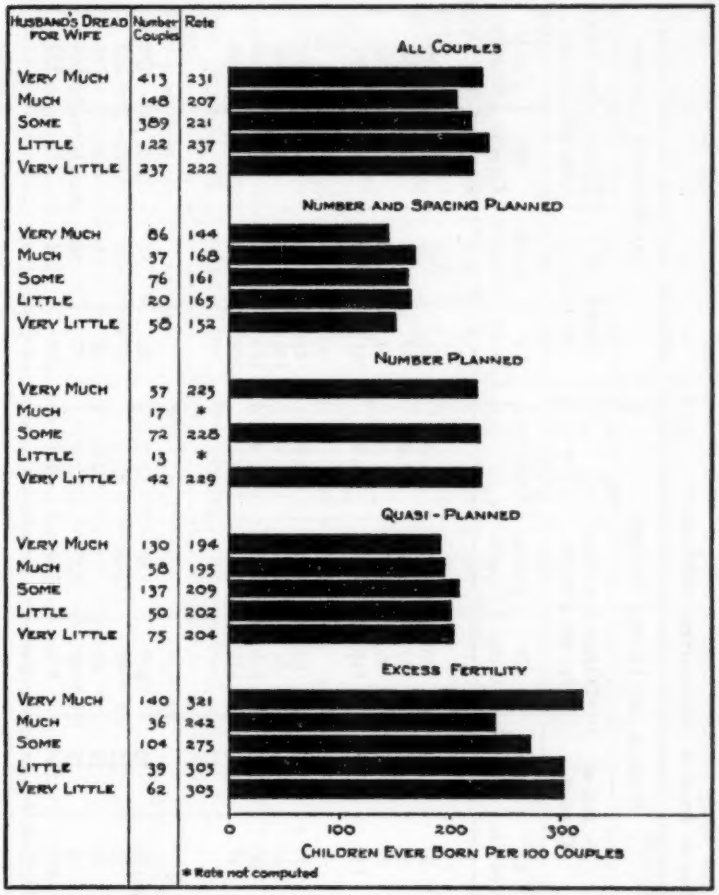

Fig. 9. Number of children ever born per 100 couples by fertility-planning status and by husband's dread of childbirth for wife before first child was born.

all pregnancies) and the extent to which the couple was discouraged from having more children because of fear of pregnancy disappears when the analysis is restricted to fertile couples. (Tables 11–13).

The differentials in proportions childless by the various measures of fear of pregnancy are quite striking. Thus among

Table 11. Fertility rates for all couples and fertile couples and per cent childless among "number and spacing planned" couples and "all planned families," by separate and jointly considered reply of wife and husband on extent to which the couple had been discouraged from having (more) children by fear or dread of pregnancy and childbirth.

Extent Discouraged From Having (More) Children by Fear of Pregnancy and Childbirth		Number and Spacing Planned					All Planned Families				
		Number of Couples		Children Ever Born Per 100 Couples		Per Cent Childless	Number of Couples		Children Ever Born Per 100 Couples		Per Cent Childless
		All Couples	Fertile Couples	All Couples	Fertile Couples		All Couples	Fertile Couples	All Couples	Fertile Couples	
Reply of Wife											
Very Much or Much		50	28	80	143	44.0	68	46	128	189	32.4
Some		60	36	97	161	40.0	87	63	141	195	27.6
Little		74	51	99	143	31.1	92	69	121	161	25.0
Very Little		219	162	118	159	26.0	361	300	160	192	16.9
Reply of Husband											
Very Much or Much		57	28	65	132	50.9	81	50	114	184	38.3
Some		67	36	72	133	46.3	104	73	130	185	29.8
Little		80	57	120	168	28.8	121	96	149	188	20.7
Very Little		195	152	124	159	22.1	298	255	162	190	14.4
Joint Replies[1]											
Wife	*Husband*										
V. M. or M.	V. L. or L.	29	22	117	155	24.1	38	31	145	177	18.4
Some	V. L. or L.	38	22	87	150	42.1	52	36	131	189	30.8
V. L. or L.	V. M. or M.	30	15	63	*	50.0	48	31	119	184	35.4
V. L. or L.	Some	51	29	69	121	43.1	72	50	115	166	30.6
V. L. or L.	V. L. or L.	208	165	130	164	20.7	329	284	164	190	13.7

[1] Combinations represented by fewer than 20 cases are not shown.
* Rate not shown for fewer than 20 cases.

Table 12. Fertility rates for all couples and fertile couples and per cent childless among "number and spacing planned" couples and "all planned families" according to wife's opinion, husband's opinion, wife's rating of husband's opinion, and husband's rating of wife's opinion about risk to wife's health in having a (another) child.

Risk to Wife's Health in Having A (Another) Child (Relative to "Most" Women)	Number and Spacing Planned					All Planned Families				
	Number of Couples		Children Ever Born Per 100 Couples		Per Cent Childless	Number of Couples		Children Ever Born Per 100 Couples		Per Cent Childless
	All Couples	Fertile Couples	All Couples	Fertile Couples		All Couples	Fertile Couples	All Couples	Fertile Couples	
Wife's Opinion										
Very Much or Much More	46	35	107	140	23.9	59	48	142	175	18.6
Somewhat More	86	73	124	147	15.1	128	113	152	173	11.7
About Average	240	144	97	162	40.0	372	274	144	196	26.3
Somewhat or Much Less	31	25	129	160	19.4	49	43	165	188	12.2
Husband's Opinion										
Very Much or Much More	70	48	89	129	31.4	99	73	129	175	26.3
Somewhat More	91	61	105	157	33.0	137	107	140	179	21.9
About Average	212	145	109	159	31.6	322	255	149	189	20.8
Somewhat or Much Less	30	23	133	174	23.3	50	43	192	223	14.0
Wife's Rating of Husband's Opinion										
Very Much or Much More	55	39	107	151	29.1	77	61	158	200	20.8
Somewhat More	105	81	120	156	22.9	154	128	146	176	16.9
About Average	205	128	95	152	37.6	316	237	141	189	25.0
Somewhat or Much Less	36	29	136	169	19.4	58	51	172	196	12.1
Husband's Rating of Wife's Opinion										
Very Much or Much More	62	45	84	116	27.4	85	68	131	163	20.0
Somewhat More	61	40	102	155	34.4	94	71	143	189	24.5
About Average	227	150	107	162	33.9	337	258	143	187	23.4
Somewhat or Much Less	50	42	144	171	16.0	89	81	191	210	9.0

the "planned families" the proportion childless extends from 16 per cent for those with wives classified as having lowest fear of pregnancy to 79 per cent for those with wives classified as having highest fear of pregnancy.

It is of interest to examine the distributions of couples by wife's fear of successive pregnancies. These are given in Table 14 for all couples, planned families, and families that were not planned as to size. In the first place, the relatively high fear of pregnancy and childbirth by the never-pregnant wives may be noted. One-third (33 per cent) of the never-pregnant wives stated "very much" or "much" fear, and 42 per cent stated "very little" fear. In comparison, only 6 per cent of all wives having a first pregnancy stated that they had feared it "very much" or "much" and 77 per cent replied "very little."

A second point apparent in Table 14 is that among all couples and among the families not planned as to size, the proportion

Table 13. Fertility rates for all couples and fertile couples and per cent childless among "number and spacing planned" couples and "all planned families", by average of ratings on wife's fear of pregnancy.

Average of Ratings on Wife's Fear of Pregnancy	Number of Couples		Children Ever Born Per 100 Couples		Per Cent Childless
	All Couples	Fertile Couples	All Couples	Fertile Couples	
	Number and spacing planned				
1–1.9 (High Fear)	28	6	29	*	78.6
2–2.9	23	6	35	*	73.9
3–3.9	50	33	108	164	34.0
4–4.9	52	37	137	192	28.8
5 (Low Fear)	250	195	115	148	22.0
	All planned families				
1–1.9 (High Fear)	28	6	29	*	78.6
2–2.9	32	13	84	*	59.4
3–3.9	72	55	160	209	23.6
4–4.9	115	100	190	218	13.0
5 (Low Fear)	359	302	147	175	15.9

* Rate not shown for fewer than twenty cases.

of wives stating that they had feared experienced pregnancies "very much" increases fairly regularly with order of pregnancy. This type of relation is not found among the planned families except for the relatively low fear of the experienced first pregnancy. However, the proportion of wives in planned families indicating "very little" fear of specific pregnancies experienced does decline regularly with successive order of pregnancy. A third point to be noted is that except for never-pregnant wives

Table 14. Percentage distribution of couples according to wife's fear of pregnancies of specific order. Data presented for all couples and for planned and non-planned families.

Order of Pregnancy Considered	Number of Couples	Per Cent Distribution by Fear of Pregnancy					
		Total	Very Much	Much	Some	Little	Very Little
		ALL COUPLES REGARDLESS OF FERTILITY-PLANNING STATUS					
First (All Couples)	1,437	100	5.7	2.3	7.5	10.1	74.4
First (Never Pregnant)	121	100	19.0	14.0	13.2	11.6	42.1
Pregnancies Experienced							
First	1,316	100	4.5	1.2	7.0	10.0	77.4
Second	1,007	100	7.7	4.0	6.6	14.7	67.0
Third	511	100	9.4	4.1	6.7	15.1	64.8
Fourth	239	100	10.5	2.9	7.5	11.3	67.8
Fifth	107	100	15.9	3.7	7.5	6.5	66.4
Sixth or Later	81	100	14.8	7.4	6.2	4.9	66.7
		ALL PLANNED FAMILIES					
First (All Couples)	606	100	4.6	4.5	9.2	9.1	72.6
First (Never Pregnant)	121	100	19.0	14.0	13.2	11.6	42.1
Pregnancies Experienced							
First	485	100	1.0	2.1	8.2	8.5	80.2
Second	339	100	5.3	4.1	5.9	12.4	72.3
Third	112	100	3.6	4.5	6.3	16.1	69.6
Fourth	36	100	5.6	5.6	8.3	16.7	63.9
		FAMILIES NOT PLANNED AS TO SIZE					
Pregnancies Experienced							
First	831	100	6.5	0.7	6.3	10.8	75.7
Second	668	100	9.0	3.9	6.9	15.9	64.4
Third	399	100	11.0	4.0	6.8	14.8	63.4
Fourth	203	100	11.3	2.5	7.4	10.3	68.5
Fifth	100	100	16.0	4.0	8.0	7.0	65.0
Sixth or Later	77	100	15.6	7.8	6.5	5.2	64.9

the fear of specific pregnancies is generally lower for planned families than for the non-planned.

The reasons for the three situations noted above may be briefly considered. There are several possible reasons for the relatively high fear of a pregnancy and childbirth among the never-pregnant wives. In the first place, it will be recalled that replies of never-pregnant women to the question on fear of "a pregnancy and childbirth" represent their current attitudes at the time of the interview. Women with histories of pregnancies, on the other hand, were asked the extent to which they had feared pregnancy and childbirth prior to the occurrence of the pregnancy considered. Therefore, there may be differences arising from the fact that replies of the women with pregnancies were *ex post facto,* whereas those of the never-pregnant women were not.

Perhaps more important, however, is the difference in time reference and hence the difference in age of the women at the time considered. The never-pregnant women replied to the question in the context of their age at interview, whereas the replies about fear of *experienced* first pregnancies related to periods when the women might have been as much as 14 years younger than at the time of the interview. In this connection it is of interest to note that one-third of the forty childless women who replied that they feared pregnancy and childbirth "very much" or "much" listed "age" as one of the reasons for the fear. None of the thirteen women in planned families who feared their actual first pregnancy "very much" or "much" listed "age" as one of the reasons for fear. (*See* Appendix II for data and discussion of reasons for fear or lack of fear of pregnancy among wives in planned families.)

It is also germane to mention that the actual age at interview tends to be substantially higher for the never-pregnant women than for the others. About 50 per cent of the never-pregnant women as compared with 30 per cent of the others were 35 years of age or over at the time of the interview. Despite the above situations, however, among the never-preg-

nant women themselves, the distributions by fear of pregnancy are about the same for women 35–39 years of age as for those 30–34 years of age, the two chief five-year age groups represented.[20, 21]

A final point to be noted is that by definition the never-pregnant women in the Study did not want children. They had practiced contraception regularly since marriage. Some actually may have been deterred by fear of pregnancy and childbirth. It also seems likely, however, that some may have seized upon fear of pregnancy as a sort of rationalization.

The fact that the planned families effectively restricted births to the number desired is perhaps an important reason why fear of pregnancy increases little by order of pregnancy among this group. It may also be an important reason for the generally lower fear of specific pregnancies among wives in planned families than among the others.

[20] The complete distribution by age is as follows:

Age of Wife at Interview	Total	Never Pregnant	With One or More Pregnancies
Number	1,444	121	1,323
Per Cent: (Total)	100.0	100.0	100.0
Under 30	8.9	0.8	9.7
30–34	59.8	48.8	60.8
35–39	28.0	37.2	27.1
40+	3.3	13.2	2.4

[21] The distribution of the never-pregnant woman by age and fear of pregnancy is as follows:

Age of Wife at Interview	Fear of Pregnancy and Childbirth					
	Total	Very Much	Much	Some	Little	Very Little
Total	121	23	17	16	14	51
Under 30	1					1
30–34	59	13	8	6	6	26
35–39	45	10	4	5	6	20
40+	16		5	5	2	4

This lower fear of specific pregnancies experienced by wives in planned families than by wives in families not planned as to size persists when number of pregnancies ever experienced is held constant. This is evident from a comparison of Tables 15 and 16, which present percentage distributions for planned and non-planned families, respectively, by wife's fear of specific pregnancies and by total number of pregnancies experienced. For example, the proportion of wives in planned families stating that they feared the second pregnancy "very much" is 4.4 per cent for those having only two pregnancies, 4.2 per cent for those with three pregnancies, and 6.7 per cent for those with

Table 15. Percentage distribution of planned families by wife's fear of pregnancies of specific order, according to total number of pregnancies experienced.

Number Pregnancies Experienced	Number of Couples	Per Cent Distribution by Wife's Fear of Pregnancy					
		Total	Very Much	Much	Some	Little	Very Little
	Fear of first pregnancy						
Total[1]	606	100	4.6	4.5	9.2	9.1	72.6
0	121	100	19.0	14.0	13.2	11.6	42.1
1	143	100	1.4	4.2	9.8	5.6	79.0
2	229	100	0.9	0.9	8.3	10.9	79.0
3	75	100	1.3	2.7	9.3	8.0	78.7
4	30	100	0.0	0.0	0.0	3.3	96.7
	Fear of second pregnancy						
Total[1]	339	100	5.3	4.1	5.9	12.4	72.3
2	229	100	4.4	3.9	7.4	14.0	70.3
3	72	100	4.2	5.6	0.0	6.9	83.3
4	30	100	6.7	3.3	10.0	16.7	63.3
	Fear of third pregnancy						
Total[1]	112	100	3.6	4.5	6.3	16.1	69.6
3	75	100	2.7	4.0	8.0	13.3	72.0
4	29	100	3.4	6.9	3.4	17.2	69.0
	Fear of fourth pregnancy						
Total[1]	36	100	5.6	5.6	8.3	16.7	63.9
4	28	100	7.1	3.6	0.0	21.4	67.9

[1] Includes eight couples with five or more pregnancies and with wife giving information on fear.

four pregnancies. (Table 15) Among wives in non-planned families the corresponding percentages are 9.0, 9.8, and 10.2. (Table 16)

Among neither the planned families nor the others, apart from never-pregnant couples, is there much relation of wife's

Table 16. Percentage distribution of families not planned as to size, by wife's fear of pregnancies of specific order, according to number of pregnancies experienced.

Number Pregnancies Experienced	Number of Couples	Per Cent Distribution by Wife's Fear of Pregnancy					
		Total	Very Much	Much	Some	Little	Very Little
	FEAR OF FIRST PREGNANCY						
Total[1]	831	100	6.5	0.7	6.3	10.8	75.7
1	164	100	5.5	0.0	7.9	15.9	70.7
2	268	100	5.2	0.0	5.6	11.6	77.6
3	190	100	7.9	2.1	7.9	11.6	70.5
4	110	100	7.3	1.8	2.7	6.4	81.8
5	54	100	7.4	0.0	5.6	3.7	83.3
	FEAR OF SECOND PREGNANCY						
Total[1]	668	100	9.0	3.9	6.9	15.9	64.4
2	267	100	9.0	2.2	8.2	17.2	63.3
3	193	100	9.8	4.7	7.8	20.2	57.5
4	108	100	10.2	4.6	3.7	10.2	71.3
5	55	100	7.3	7.3	5.5	7.3	72.7
	FEAR OF THIRD PREGNANCY						
Total[1]	399	100	11.0	4.0	6.8	14.8	63.4
3	190	100	11.1	4.7	10.0	17.4	56.8
4	109	100	11.0	4.6	3.7	12.8	67.9
5	55	100	16.4	1.8	0.0	16.4	65.5
	FEAR OF FOURTH PREGNANCY						
Total[1]	203	100	11.3	2.5	7.4	10.3	68.5
4	104	100	12.5	1.9	11.5	14.4	59.6
5	54	100	13.0	1.9	1.9	1.9	81.5
	FEAR OF FIFTH PREGNANCY						
Total[1]	100	100	16.0	4.0	8.0	7.0	65.0
5	55	100	20.0	5.5	5.5	7.3	61.8

[1] Includes forty-five couples with six or more pregnancies and with wife giving information on fear.

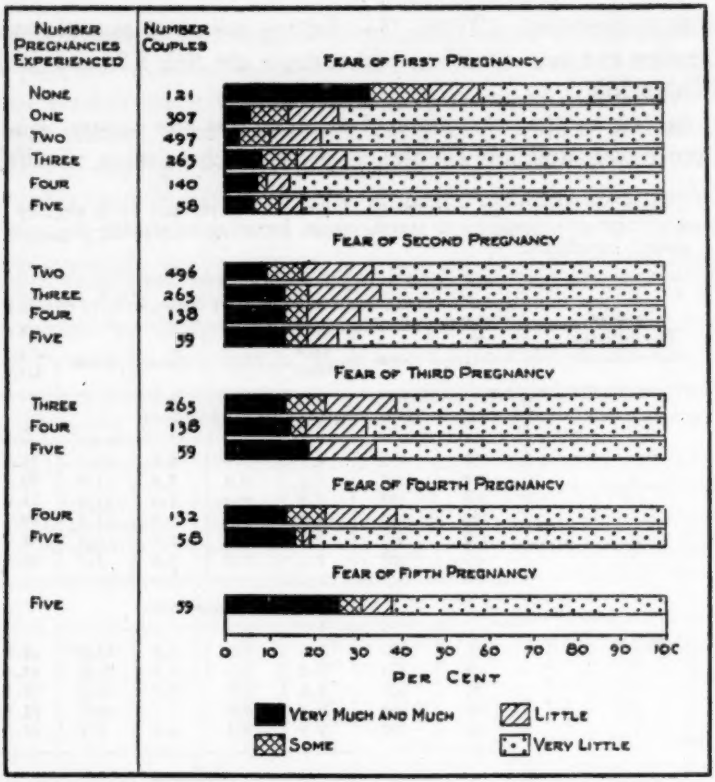

Fig. 10. Percentage distribution of all couples by wife's fear of pregnancies of specific order, according to total number of pregnancies experienced. (*See* Table 17)

fear of a specific pregnancy to total number of pregnancies experienced. There may be a little more tendency for wife's fear of a specific pregnancy to be directly related to total number of pregnancies among the non-planned than among the planned families. This is illustrated by the figures given in the preceding paragraph. However, the outstanding feature is the lack of substantial variations in fear of specific pregnancies experienced, by total number of pregnancies. This type of stability is depicted in Figure 10 based upon Table 17 and relating

to all couples regardless of fertility-planning status. It provides another indication of the lack of any important relation of fear of pregnancy to fertility of couples in the Indianapolis Study.

That the relatively high fear of pregnancy and childbirth on the part of women with no pregnancy accounts almost entirely

Table 17. Percentage distribution of all couples by wife's fear of pregnancies of specific order, according to total number of pregnancies experienced.

Number Pregnancies Experienced	Number of Couples	Per Cent Distribution by Wife's Fear of Pregnancy					
		Total	Very Much	Much	Some	Little	Very Little
	FEAR OF FIRST PREGNANCY						
Total[1]	1,437	100	5.7	2.3	7.5	10.1	74.4
0	121	100	19.0	14.0	13.2	11.6	42.1
1	307	100	3.6	2.0	8.8	11.1	74.6
2	497	100	3.2	0.4	6.8	11.3	78.3
3	265	100	6.0	2.3	8.3	10.6	72.8
4	140	100	5.7	1.4	2.1	5.7	85.0
5	58	100	6.9	0.0	5.2	5.2	82.8
	FEAR OF SECOND PREGNANCY						
Total[1]	1,007	100	7.7	4.0	6.6	14.7	67.0
2	496	100	6.9	3.0	7.9	15.7	66.5
3	265	100	8.3	4.9	5.7	16.6	64.5
4	138	100	9.4	4.3	5.1	11.6	69.6
5	59	100	6.8	6.8	5.1	6.8	74.6
	FEAR OF THIRD PREGNANCY						
Total[1]	511	100	9.4	4.1	6.7	15.1	64.8
3	265	100	8.7	4.5	9.4	16.2	61.1
4	138	100	9.4	5.1	3.6	13.8	68.1
5	59	100	16.9	1.7	0.0	15.3	66.1
	FEAR OF FOURTH PREGNANCY						
Total[1]	239	100	10.5	2.9	7.5	11.3	67.8
4	132	100	11.4	2.3	9.1	15.9	61.4
5	58	100	12.1	3.4	1.7	1.7	81.0
	FEAR OF FIFTH PREGNANCY						
Total[1]	107	100	15.9	3.7	7.5	6.5	66.4
5	59	100	20.3	5.1	5.1	6.8	62.7

[1] Includes 48–49 couples with six or more pregnancies and with wife giving information on fear of specified pregnancy.

for the inverse relation of pregnancy rates to wife's fear of first pregnancy is pointed up in Table 18. This table presents for all couples and for all planned families pregnancy rates with and without the inclusion of never-pregnant women according to wife's fear of first pregnancy. Among all couples and among the planned families, pregnancy rates increase regularly and sharply with lowering of fear of first pregnancy *when the experience of the never-pregnant women is included.* The relative spread of the pregnancy rates by wife's fear of first pregnancy is much larger among planned families than among all couples. Thus, among planned families the pregnancy rate extends from 45 for wives fearing the first pregnancy "very much" or "much" to 184 for those fearing it "very little." The corresponding rates for all couples are 182 and 240, respectively.

Table 18. Pregnancy rates for all couples and for couples with one or more pregnancies, and per cent of couples never pregnant, according to wife's fear of first pregnancy. Data presented for all couples regardless of fertility-planning status and for all planned families.

Wife's Fear of First Pregnancy	Number of Couples		Pregnancies Per 100 Couples		Per Cent of Couples Never Pregnant
	All Couples (Incl. Never Pregnant)	Couples With One or More Pregnancies	All Couples (Incl. Never Pregnant)	Couples With One or More Pergnancies	
	ALL COUPLES REGARDLESS OF FERTILITY-PLANNING STATUS				
Total	1,444[a]	1,323[a]	228	248	8.4
Very Much or Much	115	75	182	279	34.8
Some	108	92	193	226	14.8
Little	145	131	201	223	9.7
Very Little	1,069	1,018	240	252	4.8
	ALL PLANNED FAMILIES				
Total	608[b]	487[b]	164	204	19.9
Very Much or Much	55	15	45	*	72.7
Some	56	40	130	183	28.6
Little	55	41	155	207	25.5
Very Little	440	389	184	208	11.6

[a] Total includes seven couples with no rating on fear of first pregnancy.
[b] Total includes two couples with no rating on fear of first pregnancy.
* Rate not shown for fewer than twenty cases.

There is a correspondingly regular and strong *decrease* in the percentage of never-pregnant couples with lowering of wife's fear of first pregnancy. Among the planned families these percentages extend from about 73 per cent for wives fearing first pregnancy "very much" and "much" to 12 per cent for those with "very little" fear. Among all couples the range is from about 35 to 5 per cent.

When the analysis is restricted to couples with one or more pregnancies there is very little persistence of the inverse relation of pregnancy rates to wife's fear of first pregnancy. In fact, among all wives experiencing a first pregnancy the rate (279) is highest instead of lowest for those stating that they feared the first pregnancy "very much" or "much." Owing to small numbers a comparable rate is not available for the planned families but among these the rates are 183, 207, and 208, respectively, for wives stating that they had feared their first pregnancy "some," "little," and "very little."

Table 19 takes as a point of departure the pregnancy rates by fear of experienced first pregnancies and presents similar data by fear of experienced second, third, and fourth pregnancies. For possible help in interpretation, this table shows not only the total pregnancies per 100 couples but also the number of pregnancies *after the one considered* per 100 couples, and the percentage of couples having one or more pregnancies after the one considered, by wife's fear of specified pregnancies. As before, the data are shown for all couples and for planned families in so far as those for the latter group are adequate.

In the nature of the case the rates of total pregnancies increase and the rates of *additional* pregnancies *decrease* as one considers successively the wives experiencing at least one pregnancy, at least two pregnancies, etc. Our concern here is with the internal variations of the rates by fear of pregnancies considered. The results are interesting. If the relatively high pregnancy rates for women professing "very much" or "much" fear are ignored, we find rather consistent increases in pregnancy rates with lowering of fear. Stated in another manner,

Table 19. Total number of pregnancies per 100 couples, number of pregnancies after the one considered per 100 couples, and per cent of couples having one or more pregnancies after the one considered, according to wife's fear of specified pregnancy. Data presented for all couples and for all planned families.

Experienced Pregnancy Considered and Fear of That Pregnancy	All Couples				All Planned Families			
	Number of Couples	Pregnancies Per 100 Couples		Per Cent of Couples Having an Additional Pregnancy	Number of Couples	Pregnancies Per 100 Couples		Per Cent of Couples Having an Additional Pregnancy
		Total	Additional			Total	Additional	
First Pregnancy								
Very Much and Much	75	279	179	77.3	15	*	*	*
Some	92	226	126	70.7	40	183	83	65.0
Little	131	223	123	74.0	41	207	107	80.5
Very Little	1,018	252	152	77.5	389	208	108	71.0
Second Pregnancy								
Very Much and Much	118	307	107	58.5	32	278	78	40.6
Some	66	270	70	40.9	20	230	30	15.0
Little	148	279	79	47.3	42	236	36	23.8
Very Little	675	297	97	51.1	245	247	47	34.3
Third Pregnancy								
Very Much and Much	69	375	75	49.3	9	*	*	*
Some	34	365	65	26.5	7	*	*	*
Little	77	371	71	44.2	18	*	*	*
Very Little	331	393	93	51.1	78	338	38	30.8
Fourth Pregnancy								
Very Much and Much	32	463	63	43.8	4	*	*	*
Some	18	*	*	*	3	*	*	*
Little	27	441	41	22.2	6	*	*	*
Very Little	162	491	91	50.0	23	426	26	17.4

* Rates and percentages not shown if based on fewer than 20 cases.

among women who had pregnancies of a given order the percentage having one or more additional pregnancies is consistently relatively high for those indicating that they had feared the index pregnancy "very much" or "much" but the percentages of couples having an additional pregnancy otherwise increase with lowering of fear of the pregnancy considered.[22]

The implications in Table 19 would seem to be that if number of previous past pregnancies is held constant, there is a partial tendency for the occurrence of a subsequent pregnancy to be inversely related to *fear of the previous pregnancy*. However, the exception is an important one in that the percentage of women having an additional pregnancy is consistently high for those expressing "very much" or "much" fear of pregnancy.

A less refined but in some respects more meaningful set of data are presented in Table 20 in which the numbers of women

Table 20. Number of couples ever exposed to risk of pregnancy of specified order and percentage of couples at risk having the pregnancy, by average of ratings on wife's fear of pregnancy. Data presented for all couples and for "all planned families."

Average of Ratings on Wife's Fear of Pregnancy	All Couples					
	Order of pregnancy					
	First	Second	Third	Fourth	Fifth	Sixth
	Number of couples ever exposed to risk of given pregnancy					
Total[1]	1,444	1,323	1,014	516	248	108
1–2.9 (High Fear)	122	83	66	43	24	11
3–3.9	203	187	158	98	41	21
4–4.9	328	313	279	152	81	33
5 (Low Fear)	786	735	506	220	102	43
	Per cent of couples at risk who had given pregnancy					
Total[1]	91.6	76.6	50.9	48.1	43.5	45.4
1–2.9 (High Fear)	68.0	79.5	65.2	55.8	45.8	*
3–3.9	92.1	84.5	62.0	41.8	51.2	47.6
4–4.9	95.4	89.1	54.5	53.3	40.7	57.6
5 (Low Fear)	93.5	68.8	43.5	46.4	42.2	37.2

[22] It must be borne in mind that the classifications in Table 19 are on the basis of fear of the pregnancy considered—not on the basis of fear of *another* pregnancy.

experiencing given pregnancies are expressed as percentages of the total number ever exposed to the risk of pregnancies of the orders considered.[23] This time the data are shown not according to fear of a specific pregnancy, as in Table 19, but according to average of the wife's ratings on fear of all pregnancies experienced.[24] They are shown for planned families as well as for all couples.

As expected, the proportion of couples having a first pregnancy increases with lowering of average fear. A partial relation of this type is found in so far as the probability of second pregnancy is concerned. However, the percentages of couples at risk who had pregnancies of higher orders do not vary systematically with average ratings of fear on all pregnancies.

Table 20 (*continued*). Number of couples ever exposed to risk of pregnancy of specified order and percentage of couples at risk having the pregnancy, by average of ratings on wife's fear of pregnancy. Data presented for all couples and for "all planned families."

Average of Ratings on Wife's Fear of Pregnancy	All Planned Families			
	Order of Pregnancy			
	First	Second	Third	Fourth
	Number of couples ever exposed to risk of given pregnancy			
Total[1]	608	487	344	113
1–2.9 (High Fear)	60	21	13	4
3–3.9	72	56	42	12
4–4.9	115	100	92	39
5 (Low Fear)	359	308	195	58
	Per cent of couples at risk who had given pregnancy			
Total[1]	80.1	70.6	32.8	33.6
1–2.9 (High Fear)	35.0	61.9	*	*
3–3.9	77.8	75.0	28.6	*
4–4.9	87.0	92.0	42.4	41.0
5 (Low Fear)	85.8	63.3	29.7	27.6

* Per cent not shown if based on fewer than twenty cases.
[1] Totals include unknowns on average ratings on fear.

[23] All women were presumed to be exposed to the risk of a first pregnancy. Those experiencing a first pregnancy became exposed to the risk of a second, etc.

[24] As before, for purposes of computing the probability of a first pregnancy, the never pregnant women were incorporated on the basis of their fear of "a pregnancy."

SUMMARY

Four major criteria of fear of pregnancy are available from the Indianapolis Study for testing the hypothesis "the greater the fear of pregnancy the higher the proportion of couples practicing contraception effectively, and the smaller the planned families." These are (1) statements of each spouse on the extent to which the couple had been discouraged from having (more) children by fear or dread of pregnancy and childbirth; (2) husband's dread of childbirth for wife before the first child was born; (3) statements of each spouse on the degree of risk (relative to "most women") the wife would run in having a (another) child; and (4) wife's previous fear of each pregnancy experienced or her current fear if never pregnant.

The first part of the hypothesis, the greater the fear the higher the proportion of planned families, is not supported at all when the criterion of fear is (1) "extent discouraged" (wife's or husband's statement), (2) "husband's dread" or (3) wife's statement on "risk to wife's health." It is supported by husband's statement on "risk to wife's health." This support is not statistically significant but it does persist when the analysis is restricted to fertile husbands. When the average of wife's ratings on fear of pregnancy is used as the criterion of fear, the first part of the hypothesis is supported when childless wives are included but not when they are excluded from the analysis. Similarly when wife's fear of first pregnancy is considered, the hypothesis is supported when the never-pregnant wives are included but not when they are excluded. The hypothesis is not supported in classifications based upon fear of specific pregnancies experienced after the first.

The second part of the hypothesis, the greater the fear of pregnancy the smaller the planned family, is supported when any of the criteria except "husband's dread" is used. However, the support virtually disappears when the analysis is restricted to fertile couples.

The important role of childless couples in giving support to

both parts of the hypothesis arises from the facts that (a) most of the childless wives were never pregnant, (b) the never-pregnant wives exhibited relatively high fear of "a pregnancy," and (c) the never-pregnant wives in the Study are by definition restricted to the "number and spacing planned" group.

Appendix I

Tests of Significance of Differences in Fertility Rates

On the basis of the standard errors of the means of the distributions by number of live births and the *t* test, significances of differences between fertility rates for selected subgroups represented in Figures 6, 7, and 8 were tested. For this purpose the total number of cases (*n*) for the subgroups were reduced to the size of the uninflated sample. The proportionate distributions by number of live births observed in the inflated sample were applied to the numbers in the uninflated sample. In other words, the fertility rates found in the inflated sample were maintained but the numbers of cases on which they were based were reduced for the tests of significance. The symbols used are to be interpreted as follows: VS = very significant ($p = .01$ or less); S = moderately significant (p between .01 and .05); and N = not significant ($p > .05$).

Groups Compared with Respect to Average Number of Live Births	Significance	
	Data For Wife	Data For Husband
All Couples		
Discouraged "very much" and "very little"	N	N
Risk to wife's health "very much more" and "much less"	N	S
Average rating on fear "high" (1–1.9) and "low" (5)	S	
Number and Spacing Planned Couples		
Discouraged "very much or much" and "very little"	S	VS
Risk to wife's health "very much more" and "somewhat or much less"	N	S
Average rating on fear "high" (1–1.9) and "low" (5)	VS	

Appendix II

Reasons for Fear or Lack of Fear of Given Pregnancies Among Planned Families

Table 21 gives some indication of the relative importance among "planned families" of various reasons for fearing given pregnancies. The data are given separately for couples in which the wife stated that she feared given pregnancies "very much" or "much" and for those in which "some" fear of given

Table 21. Importance of given reasons for fear of first and later pregnancies among wives in planned families stating that specified pregnancies were feared "very much or much" and "some."

Reasons for Fear	Fear of First Pregnancy				Fear of Second and Later Pregnancies Experienced	
	Very Much and Much		Some		Very Much and Much	Some
	All Couples	Never Pregnant	Pregnancy Experienced	All Couples		
Number of Wives	55	40	40	56	46	30
Number Reporting Reasons	53	40	40	50	43	25
Per Cent Reporting:[1]						
Fear of Death	9.4	7.5	5.0	4.0	4.7	8.0
Fear of Suffering or Illness	34.0	35.0	5.0	6.0	44.2	40.0
Fear of Abortion, Stillbirth, or Abnormality	3.8	5.0	0.0	0.0	2.3	20.0
Age (Too Old)	24.5	32.5	5.0	8.0	0.0	0.0
Complications of Previous Birth	—	—	—	—	55.8	16.0
Health of Wife	24.5	22.5	27.5	26.0	23.3	12.0
Frightened by Statements or Experiences of Friends or Relatives	35.8	40.0	30.0	30.0	7.0	12.0
Too Little Knowledge	13.2	12.5	50.0	44.0	7.0	0.0
Other Reasons	3.8	5.0	0.0	0.0	0.0	8.0

[1] Percentages based on numbers of couples listing reasons for fear. The sums of the percentages exceed 100 owing to the listing of multiple reasons for fear of given pregnancies.

pregnancies was reported. In Table 22 *the reasons for lack of fear* of pregnancies of given order are given for those replying that such pregnancies were feared "little" or "very little." In all cases the percentages add to more than 100 as a result of the multiple reasons for fear or lack of fear given by some of the women. The figures are simply to be interpreted as percentages of the total women in a given category listing a given factor as a reason for fear or lack of fear of a given pregnancy.

It will be noted that of the forty childless women stating that

Table 22. Importance of given reasons for lack of fear of specified pregnancies among wives in planned families stating that given pregnancies were feared "very little" or "little."

Reasons for Lack of Fear	Specific Pregnancies Feared "Little" or "Very Little"					
	First			Second	Third	Fourth or Later
	All Couples	Never Pregnant	Pregnancy Experienced			
Total Number of Wives	495	65	430	287	96	38
Number Giving Reasons for Lack of Fear (Percentage Bases)	391	44	347	225	77	25
Per Cent Reporting:						
Insufficient Knowledge[1]	16.9	2.3	18.7	—	—	—
Sufficient Knowledge[1]	11.3	11.4	11.2	—	—	—
Confidence Based on Prior Experience	—	—	—	37.3	31.2	32.0
Experience Mainly Favorable[2]	—	—	—	*30.2*	*23.4*	*28.0*
Experience Mainly Unfavorable[2]	—	—	—	*7.1*	*7.8*	*4.0*
Pregnancy a "Natural" Process	36.3	50.0	34.6	25.3	18.2	24.0
Not the Type that Worries	17.6	22.7	17.0	21.8	29.9	24.0
Strong Desire for Child	18.2	0.0	20.5	23.1	22.1	24.0
Good Health	10.5	22.7	8.9	2.7	6.5	4.0
Other Reasons	6.6	11.4	6.1	6.2	2.6	0.0

[1] Distinguished as reasons only in the coding of fear of first pregnancy.
[2] Subcategories based on average of ratings on complications of pregnancy, complications of the puerperium, and ease of birth for one to three prior pregnancies.

they were "very much" or "much" afraid of pregnancy and childbirth, 35 per cent mentioned as a reason the "fear or dread of suffering or illness," about 33 per cent mentioned "age," and 40 per cent stated that they had been "frightened by statements or experiences of friends or relatives." The first reason mentioned above is also one of importance among wives in planned families fearing second or later pregnancies "very much" or "much." "Complications of previous births" is another reason of outstanding importance for fearing the second or later pregnancies "very much" or "much." "Age" and "frightened by statements or experiences of friends or relatives" apparently are reasons of little or no importance for fear of the second and succeeding pregnancies among planned families.

Of the childless wives in planned families stating that they feared pregnancy "little" or "very little," half mentioned their belief that "pregnancy is a natural process" as a reason for lack of fear. About 23 per cent of the same group mentioned "good health" as a reason for lack of fear and the same proportion stated that they were "not the type that worries."

Among wives in planned families stating that they feared given pregnancies "little" or "very little" the statements "pregnancy is a natural process" and "good health of wife" tend to decrease with order of pregnancy as important reasons for not fearing the pregnancy.

ANNOTATIONS

PREVALENCE OF ARTHRITIS AND RHEUMATISM IN THE UNITED STATES[1]

THE common chronic diseases, arthritis and rheumatism, are well known to workers in the field of public health and medicine as leading causes of disability and suffering in the population at large. With new possibilities emerging in the treatment of the rheumatoid diseases, it is of utmost importance to obtain up-to-date statistical information as a means to planning programs for the effective control of such diseases.

In September, 1951, the Division of Public Health Methods conducted a survey in the United States to obtain new estimates of the number of recognized cases of chronic arthritis and muscular rheumatism. The findings from the September, 1951, survey are presented in the article "Prevalence of Arthritis and Rheumatism in the United States." The procedure used in collecting the data for this study was to add six short questions concerning arthritis and rheumatism to the interview used in one of the monthly canvasses conducted by the Census Bureau's Current Population Survey. Interviewers of the Bureau of the Census periodically visit approximately 25,000 households in sixty-eight sample areas in forty-two states and the District of Columbia. From this sample it was possible to make estimates of the amount of arthritis and rheumatism in the civilian population of the United States as a whole.

Persons reported by a family informant as having either arthritis or rheumatism were classed as "presumptive" cases. The estimated number of such cases in the civilian, noninstitu-

[1] Woolsey, Theodore D.: Prevalence of Arthritis and Rheumatism in the United States. *Public Health Reports*, June, 1952, 67, No. 6, pp. 505–512.

tional population of the United States, age 14 years and over was 10,104,000. About 75 per cent of the total number of cases had been medically attended. In 4.8 per cent of the attended cases the informant cited a diagnosis which was not considered to be arthritis or rheumatism in this survey. Another 31.7 per cent of the presumptive cases were judged to be doubtful cases either because the person had not had medical attention, or because the family did not know what the doctor's diagnosis had been. However, 63.5 per cent or an estimated 6,414,000 cases had medical care and were described by a physician as being arthritis, rheumatism, gout, lumbago, myositis or fibrositis. The author emphasizes that this estimate of 6,414,000 "diagnosed" cases was based on information obtained from lay informants who reported what they thought the doctor had said.

The prevalence rate per 100 population is discussed. For both sexes, the prevalence of presumptive cases of arthritis and rheumatism was 9.3 per cent. All cases attended by a physician yielded a prevalence rate of 6.9 per cent, and the prevalence rate for all diagnosed cases of arthritis and rheumatism was 5.9 per cent. The prevalence of all presumptive cases among females was considerably higher than among males, the rates being 10.8 and 7.6, respectively. For cases diagnosed as arthritis, the prevalence for females exceeded that for males by 80 per cent. However, the sex difference for diagnosed cases of rheumatism was not statistically significant.

Woolsey then discusses the per cent of cases in which a change in the type or amount of work was necessitated by the presence of a rheumatoid disease. Thirty-four per cent of the persons with diagnosed cases of arthritis and 29 per cent of those persons diagnosed as having rheumatism reported that their illness brought about some significant change in their employment status. When the age factor is also considered, the economic ramifications of this public health problem are clearly illustrated. Because of some form of arthritis or rheumatism 1.5–5 per cent of the population in the age group 45–65 years are forced to stop working entirely, change to part-time or occasional work, or make some other significant alteration in their employment or other usual activities.

The author also examines urban or rural residence, race, and occupation as factors affecting the prevalence of rheumatoid diseases. It was found that all forms of rheumatism and arthritis were more prevalent in farm areas than in urban populations.

The estimated number of employed civilians reported by the family informant as having arthritis or rheumatism is presented. These cases were analyzed by sex and occupation. The age-adjusted prevalence rates obtained from this analysis reveal that the highest percentage of persons who had arthritis or rheumatism were engaged in the occupation of farming. Woolsey believes: "The statistics suggest, however, that outdoor occupation may be a factor in determining the prevalence of arthritis and rheumatism."

The sex differences commented upon earlier by the author are again in evidence when men and women are compared according to occupation. Among the occupational groups in which both sexes are represented in large numbers, the age-adjusted prevalence rates for females with arthritis or rheumatism exceed those for males. Despite the fact that not all of these differences between the sexes were statistically significant, from all the prevalence rates presented, it would appear that more women than men are afflicted with the rheumatoid diseases.

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